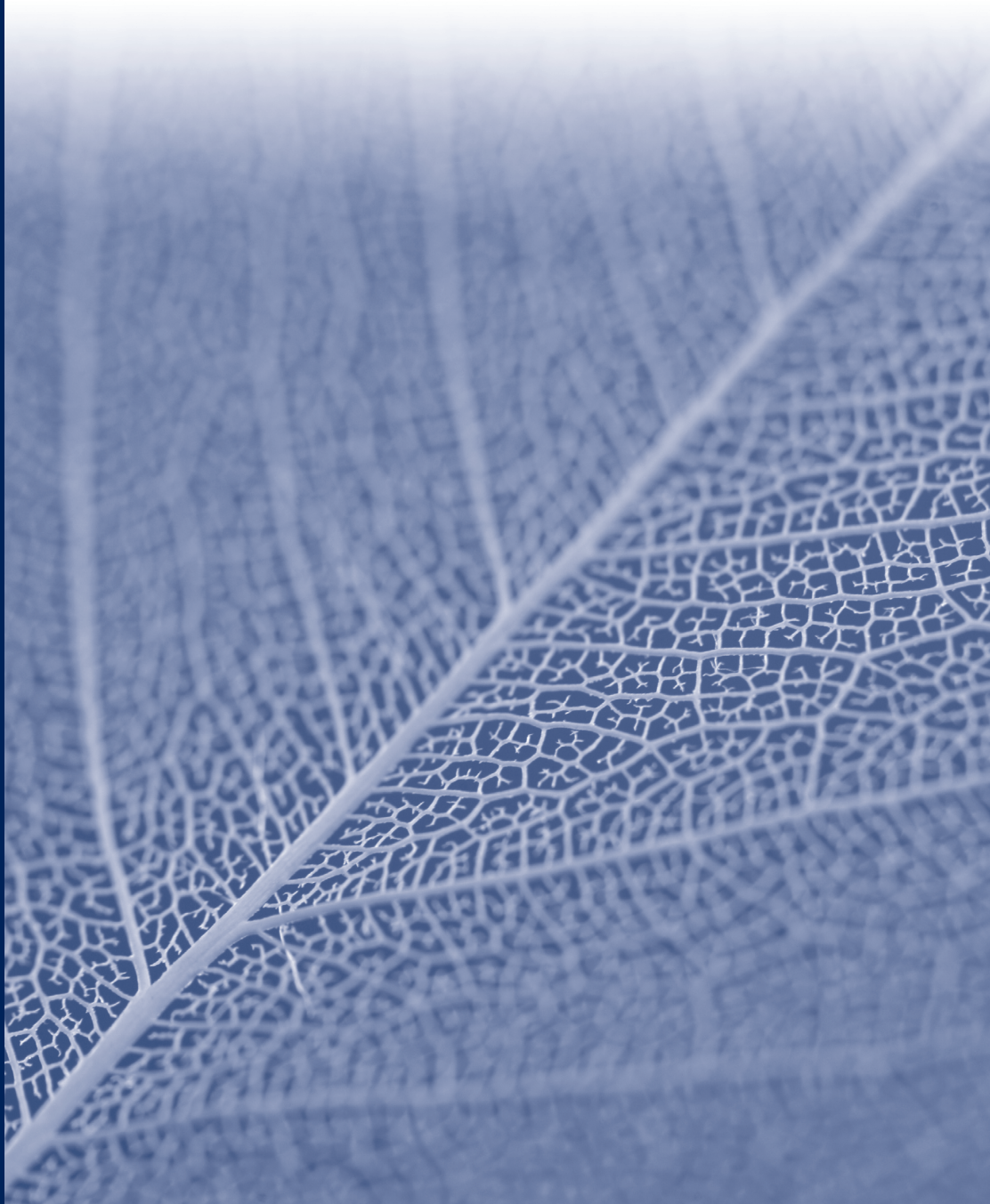
RENE VAN DER EIJK

Behind networks: Knowledge transfer, favor exchange and performance



BEHIND NETWORKS: KNOWLEDGE TRANSFER, FAVOR EXCHANGE AND PERFORMANCE

BEHIND NETWORKS: KNOWLEDGE TRANSFER, FAVOR EXCHANGE AND PERFORMANCE

Netwerken nader onderzocht:
Kennis uitwisseling, giften en prestaties

Proefschrift

ter verkrijging van de graad van doctor
aan de Erasmus Universiteit Rotterdam
op gezag van de rector magnificus
Prof.dr. S.W.J. Lamberts
en volgens besluit van het College voor Promoties.

De openbare verdediging zal plaatsvinden op
vrijdag 30 januari 2009 om 16.00 uur

door
Adriaan René van der Eijk
Geboren te Gouda

Promotor(en):
Prof.dr. S.L. van de Velde
Prof.dr.drs. W.A. Dolfsma

Overige leden:
Prof.dr. L.C.P.M. Meijs
Prof.dr. P.M.A.R. Heugens
Prof.dr. J. van den Ende

Erasmus Research Institute of Management – ERIM
Rotterdam School of Management (RSM)
Erasmus School of Economics (ESE)
Erasmus University Rotterdam
Internet: http://www.erim.eur.nl

ERIM Electronic Series Portal: http://hdl.handle.net/1765/1

ERIM PhD Series in Research in Management, number
Reference number ERIM: EPS-2009-161-LIS
ISBN 978-90-5892-190-1

Design: B&T Ontwerp en advies www.b-en-t.nl
Print: Haveka www.haveka.nl

Preface

In a number of ways, the decision to enter the world of academia to engage in research represented a personal journey. Questions such as *why* and *how* is research conducted are intriguing and far reaching. While the first question could be answered using notions such as curiosity, fascination for specific phenomena and the acquisition of worthwhile skills, I soon found out that the answer to the question *how* research is conducted is anything but unequivocal. In this case (as in many others) *how* is preceded by the *what*. What is research? According to King et al. (1994)[1] its goal is inference, its procedures public, resulting in uncertain conclusions and essential for this discussion, the content is the method[2]. The latter is meant to capture the notion that "science adheres to a set of rules of inference to which its validity depends" (ibid; p.9). Different scientific methods, such as the positivistic[3] or interpretive traditions[4], prescribe a different set of rules required in order to understand reality. Despite (post) positivistic inclinations, influenced by a Kuhnian scientific paradigm no doubt, the topic turned out to be particularly 'soft' in the sense that a large part of what constitutes a 'gift' is hard to measure. Devising a research design that would allow me to quantify relationships based on empirical observations in 'controlled environments' to find meaningful (causal) relationships turned out to be challenging. Concerns such as these in research are omnipresent, and represent 'the slippery problem of passing from statistical description to inductive generalization' (Keynes, 1939)[5]. Making sense then, also required, qualitative methods such as the use of 'thick' descriptions (Geertz, 1973)[6], although such methodologies were, to be fair, also mostly used from a positivist perspective. The notion of a single Truth, as put forward by positivists, is quite appealing and practical. Alas reality is, oftentimes if not always, a complex affair. It has been my aim (and hope) to design this study in such a manner so as to not trade breadth for depth of study and vice-versa. Breadth in terms of statistical analysis combined with depth offered by qualitative elements is sought after. The extent to which observations of this study will hold true is up for (future) falsification. It takes, as Popper (1936)[7] posits, only one 'black swan'.

1 King, G., Keohane, R.O., & Verba, S. (1994), *Designing Social Inquiry: Scientific inference in qualitative research*, Princeton University Press: Princeton (NJ).

2 Or as Pearson explains (1892:16): "the field of science is unlimited […]. The unity of all science consists alone in its method, not its material.".

3 (Logical) Positivism, first introduced by Auguste Comte, is a philosophy of science based on the notion that "the view that all true knowledge is scientific," (Bullock & Trombley, 1999) and that all things are ultimately measurable.

4 'Interpretive methods of research start from the notion that our knowledge from reality, including the domain of human action, is a social construction of human by human actors and that this applies equally to researchers. Thus there is no objective reality which can be discovered by researchers and replicated by others, in contrast to the assumptions of positivistic science (Walsham, 1993)'.

5 Keynes, J.M. (1939), 'Professor Tinbergen's Method'', *Economic Journal*, 49(195), 558—577.

6 Geertz, C. (1973), *The Interpretation of Cultures: Selected Essays*, New York: Basic Books

7 Popper, K. (1963), *Conjectures and Refutations*, Routledge, London.

Should that 'black swan' turn out to be a 'black swan' as recently posited and defined by Taleb (2007)[8], as any effect that occurred outside the realm of normal expectations, then we might have to agree with Taleb's observation that too often we fool ourselves into thinking we know more than we actually do.

If there is one central notion that this book tries to impart, it would be the idea that knowledge development is both a social as well as a cooperative effort. Creativity and new knowledge flows through and from encounters, or clashes if you will, with new ideas and people, and more specifically the ideas and knowledge the latter introduce. This research is no different, as it has benefited from many, arranged as well as chance, encounters, discussions and critiquing. The gifts of knowledge and support received during the years of research leading up to this book entitle the generous givers to equally generous acknowledgment. Gifts offered and accepted, as theory explains, act as a symbolic reminder of the continuing relationship and gratitude that according to Simmel (1996), "will always constitute a part of the bond linking them". Gratitude implies an indebtedness of some sort. As a recipient, I am indebted for contributions that came in many forms as well as from a myriad of people, people who might not necessarily be cognizant of the impact they had. Both aspects of the gift are explicitly recognized and expressed by means of the following acknowledgments.

First and foremost, I would like to express my gratitude for the support past and present, offered by my promoters, Wilfred Dolfsma, and Steef van de Velde. I thank Wilfred for a pleasant and productive cooperative effort, which survived and thrived despite commutes and several career switches. Your broad and varied research interests and ideas, input, enthusiasm, trust, continued engagement and encouragement have been invaluable for this study. By the same token I thank Steef for his support during this endeavor, his humor, phlegmatic goal-oriented mindset and not in the least his support in overcoming substantial hurdles, both expected and unexpected, proved to be indispensable.

Second, I want to thank the members of the committee; viz. Lucas Meijs, Pursey Heugens, Jan van den Ende, Roy Thurik, Arjo Klamer and Jaap Paauwe for exhibited flexibility, their time and effort in reviewing the manuscript and valuable contributions offered.

Third, I am indebted to those who have contributed by reading and discussing, this work in progress. Specifically, I wish to acknowledge the critical but always constructive conceptual and empirical contributions made by fellow researchers Bob Kijkuit, Ferdinand Jaspers, Jose Larco Martinelli and Serge Rijsdijk. The Rotterdam School of Management and in particular the Department of Management of Technology and Innovation proved to be both a pleasant and stimulating environment, making the department a thoroughly enjoyable place to work. Nowhere, became this spirit more evident than during the weekly seminars offering a stage for the presentation of new (and old) research ideas and constructive dialogue benefiting overall research quality.

8 Taleb, N. N. (2007) *The Black Swan: The Impact of the Highly Improbable*. New York: Random House

Fourth, I am grateful for the support I was given by the companies who agreed to participate in the research making data collection at their respective R&D laboratories possible. In particular I would like to thank Ridwan Sarwin, William Kloek, Wilma van Norden, Bob Poldermans, Eric Roos, Gerard Selten and Bea den Dekker for facilitating the interview and survey planning. Also I wish to thank all researchers, project managers and managers who spend time filling out the survey and/or agree to an interview, your input has been both invaluable and worthwhile.

Fifth, I owe a special thanks to longtime friends; Melvin, Esther, Gerard, Karin, Jeroen, Mariska, Steven, Josine, Bart, Erik, Henk, Sander, Leander, Mariet, Menno and Andre, who were always willing to entertain my research ideas, theoretical concepts and the inevitable up and downs that are inherent to doing a PhD. No acknowledgment would be complete, however, without an explicit recognition of Erwin's contributions. Your technical and design related expertise have been invaluable as well as your patience with my research related monologues were most appreciated.

Finally, I wish to thank Bas and Jos for being paranimfs, brothers and most importantly friends during this an all my other endeavors.

Table of Contents

List of Figures and Tables

Chapter 1
Introduction to the study

1.1 Introduction

In democratic countries knowledge of how to combine is the mother of all other forms of knowledge; on its progress depends that of all the others.
(Alexis de Tocqueville, 1835)

The general consensus among practitioners and academics is that firms' success in today's marketplace depends on their ability to innovate. Faced by this emerging reality, companies are spurred to manage, (re)combine and increase their knowledge stocks. In fact, many companies, recognizing the importance of knowledge sharing or flow, allocate significant resources in an attempt to improve internal as well as external knowledge transfers among their knowledge workers. This development has led to a recent and marked interest in the benefits of networks and technological aids for improving knowledge transfer. But the real question, as this dissertation posits, is not so much what processes aid knowledge flows but how knowledge comes to be transferred to begin with. Companies' interests are obvious but not necessarily in line with those of its employees. Why would knowledge workers want to share knowledge in light of the potential costs? If indeed motivation precedes action this question is far more relevant and has been neglected to a large extent by both practitioners and academia. This study seeks to contribute by conceptualizing knowledge transfers as 'gifts[9]' exchanged between actors. This notion has marked implications for both theory and firms as they aim to stimulate and improve knowledge flows.

Increasingly, tangible economic growth and the economic dynamics needed to fuel growth are considered to hinge on the effective use of intangible assets; (i.e. information and knowledge[10]) (OECD, 1999; 2001). For organizations, competing in today's global marketplace, this means that innovation (i.e. knowledge development and application) plays an increasingly central role in their long-term survival (Deshpandé et al., 1993; Ancona & Caldwell, 1987; Ouchi, 1981; Peters & Waterman, 1982). Indeed, knowledge has evolved into organizations' main resource for competitive advantage (Demsetz, 1988; Conner & Prahalad, 1996; Kogut & Zander 1992, 1996; Grant 1996; Nahapiet & Ghoshal, 1998). It is for this reason, that the ability of organizations to effectively generate and incorporate new knowledge has sparked the interest of both practitioners and management scholars.

Interest is justified for at least two reason; potential yields for innovations can be quite substantial and practice shows that many organizations are not satisfied with the returns

9 Throughout this study the words favor and gift (exchange) will be used interchangeably.

10 Notwithstanding the importance of knowledge throughout human history, it only became a sustained source of economic development at the beginning of the 19th century (Mokyr, 2002) when through a series of cultural changes practical and theoretical knowledge were both made more widely accessible.

on innovation spending[11]. The second point also eludates to the fact that an increase in R&D spending, although an obvious response, seems to represent only a partial answer in the quest for higher innovation success rates. Understanding knowledge creation in general and within organization specifically, as is the focus of this dissertation, thus aims to contribute to the innovation performance of organizations.

The particular research focus is based on and starts from a number of assumption regarding the nature of innovations and the associated knowledge creation process. Schumpeter's (1934) idea that innovations are new combinations of existing knowledge and incremental learning form the bedrock of this study. Schumpeter's view of innovation contains three main elements highlighting its inherently social and interactive aspects. Innovations:

(1) are *new* combinations of existing knowledge in a process that is social and involves creativity (Amabile, 1988; Woodman, Sawyer & Griffin, 1993; Perry-Smith & Shalley, 1993; Burt, 2004);
(2) are new combinations of *existing knowledge*, often not (directly) available but rather dispersed – finding information and solving problems depends to a great degree on networks of relationships (Burt, 1992; Granovetter, 1973; Rogers, 1995);
(3) require that the knowledge, once located must be *transferred*, a process that differs for the different forms of knowledge (Hansen 1999; Kogut & Zanders, 1992; Von Hippel, 1994).

Schumpeter's view on innovation inevitably requires us to take notice of two notable implications. Firstly, although innovation, which is essentially a new idea (Van der Ven, 1986; p. 591), can be described as an organizational outcome, it always involves individuals[12] (Glynn, 1996; Amabile, 1988; Woodman et al., 1993; Knight, 1967; Nonaka, 1994). Individual innovative behavior is essential as the building blocks of innovation are ideas, and it is people who "...develop, carry, react to, and modify ideas" (Van de Ven, 1986, p. 592). Secondly, the notion that innovation and the knowledge upon which they are based are a *combination* of existing knowledge has led to a focus on how knowledge is actually *exchanged* (Cohen & Levinthal, 1990; Kogut & Zander, 1992; Moran & Ghosal, 1996; Nahapiet & Ghosal, 1998; Tsai & Ghosal, 1998).

Literature, especially social network literature (SNA), tends to focus almost exclusively on structural aspects of relations between individuals, to the neglect of substantive matters related to the relations individuals maintain. As such this study aims to improve understanding of knowledge exchange among R&D scientists in organizations and the motivational drivers that underlie such behavior. R&D researchers are knowledge workers par excellence playing

11 A survey carried out by the Boston Consulting Group among 1000 executives in different industries showed that 51 percent of respondents did not feel that the investments in innovation projects yielded satisfactory returns (BCG, 2005).

12 For example Amabile (1988; 126) defined creativity as "the production of novel and useful ideas by an individual or small group of individuals working together".

a key role in an organization's capability to generate new knowledge. As such, they are essential sources (and recipients) of information and knowledge (Harrigan & Dalmia, 1991; Kachra & White, 2008). In the course of their work, R&D researchers regularly request and are requested by other R&D researchers, both within and outside the organization, to share knowledge (Harrigan & Dalmia, 1991; Kachra & White, 2008; Schrader, 1991; Allen 1977; Kreiner & Schultz 1993; Bouty 2000).

These knowledge flows between agents are, as the need for cooperation in research increases, becoming ever more important. Cooperation is necessary because innovations are based to a large extent on the 'borrowing' of previous knowledge (March & Simon, 1958, p.177-188; Tortoriello, 2006), cooperation involving a number of actors who each are dependent on others is entailed. As knowledge may be dispersed across different parties within and outside the organization, knowledge exchange underpins knowledge creation and the resulting technological progress (Ebers 1999; Moran & Ghosal, 1996; Nahapiet & Ghosal, 1998; Tsai & Ghosal, 1998). Today more than ever, cooperation and the flow of knowledge between researchers represents the key to effective knowledge creation. This development can be linked to several trends in both the kind of problems researchers work on as well as the way research is organized. Firstly, the continuous increase of the totality of available knowledge and skills makes it impossible for individuals today to master a scientific field in its entirety let alone the totality of available knowledge, cooperation therefore becomes paramount. Secondly, research problems have become increasingly interdisciplinary (Surowiecki, 2004). Wenger (2002) stresses: "Today's problem solving requires multiple perspectives. The days of Leonardo da Vinci are over". Thirdly, combining and recombining existing knowledge requires access to required knowledge resources which are accessible oftentimes via 'knowledge communities' (Wenger & Snyder, 2000; Brown & Duguid, 1991, 2001; Nonaka, 1994). Fourthly, following a trend towards open innovation (Chesbrough 2003), partly motivated by the enormous costs associated with R&D, companies increasingly engage in cooperation beyond the boundaries of the division or even the firm in order to effectively carry out innovation processes[13]. Companies move from a 'not invented here' to a 'proudly found elsewhere' paradigm.

Despite its importance, the flow or transfer of knowledge even within a single organization is far from obvious (e.g. Ghosal & Barlett 1988; Kogut & Zander 1992; Hansen 1999; Szulanski 1996; Cross et al. 2001; Winter & Szulanski 2001). Knowledge may be present with actors in a network but not be transferred for a number of reasons, contrary to what SNA implicitly assumes. Actors may not want to exchange knowledge, or may not know about the need that others have for knowledge.

13 Internet-based innovation platforms (e.g. www.innocentive.com, http://www.yourencore.com, www.yet2.com), essentially a marketplace for solutions, are increasingly seen as viable research strategies by established firms (Lakhani et al., 2007; Nambisan, et al., 2008; Gianmario et al., 2006; Sawhney et al., 2006; Sawhney et al., 2000).

Put in terms of costs even though knowledge can be shared at no direct cost[14], there are opportunity costs in terms of effort, time, uncertainty[15] and redundancy[16] (Reagens & McEvily, 2003). As Huysman and de Wit (2004) point out "Knowledge sharing cannot be forced; people will only share knowledge if there is a personal reason to do so" the reality of which is implied by the very nature of knowledge (e.g. Wenger & Snyder, 2000; Wenger, 1998; Brown & Duguid, 1991; 2001).

Under these assumptions, this dissertation investigates why individuals inside organizations, in the absence of clearly defined, formal, enforceable obligations, feel compelled and continue to provide recipients with knowledge? An explanation for how actors are able to solicit the cooperation and exchange of knowledge from people within and outside of their network, is offered by the notion of favor or gift exchange[17]. Gift exchange, not necessarily fully voluntary, is driven by obligations of a social and informal nature (Dolfsma & Van der Eijk 2008). Gift exchange, involving altruistic as well as more self-interested motives, provides the parties involved with a mechanism for the exchange of resources and an incentive to so. Social obligations stemming from favor exchange and the network position one inhabits can be employed to try to elicit future support (Coleman, 1988) for instance to acquire the knowledge or resources needed for (future) projects (cf. Avner 1997; Blau 1964; Bourdieu 1977, 1986; Humphrey & Hugh-Jones 1992; Darr 2003). The analysis looks specifically at *who* exchanges frequently within an organization, *what* position individuals inhabit within the organizational social network structure and *how* gift exchange behavior contributes to knowledge creation within the organization. Adopting a network (SNA) perspective, we will investigate knowledge creation and diffusion and the role of gift exchange.

1.2 Note on the nature of gift exchange

Many have, over the course of this research, inquired into or debated heatedly even the nature of gift exchange. In so doing, it seemed that the topic implicitly touches upon deeply held, although for some more than others, believes of what drives human behavior. As such, positioning gift exchange theory in the context of altruism vs. self-interest debate is likely to be a welcome bookmark.

14 Intellectual objects are non-rivalrous: they are not consumed by their use (Alder, 2001; Arrow, 1984), meaning that you can transfer knowledge and retain it for one's self.

15 Intellectual objects or knowledge are (quasi) public goods, in that they are non-exclusive: consumption or use by non-payers cannot be excluded. Once transferred use is difficult to monitor and enforce ex post (Appeleyard, 1996; Pfeffer, 1981; Schrader, 1991; Kachra & White, 2008).

16 Sir Francis Bacon's famous quote "knowledge is power" eloquently makes the point that knowledge represents a powerful resource. Sharing knowledge creates redundancy and as such represents the risk of a possible deterioration of the donor's position vis-à-vis other individuals (Davenport, 1997; Reagens & McEvily, 2003).

17 Gift exchange is the, in fulfillment of an obligation or spontaneous, conference of some material or intangible benefit that is, consciously or unconsciously, subject to expectations of reciprocity whereby the particulars of the return in terms of form and time are left unspecified at the time of the transaction.

Although the notion of gift exchange is well documented and researched in many context, ranging from its anthropological roots to more recently economic contexts, the concept is associated with a number of commonly-held (though wrong) believes about gift giving,

Gift giving by most is associated with the giving of presents and is motivated by altruistic behavior; no ulterior motives are in play. A recent book "Giving" by Bill Clinton (2007) as a case in point, also exemplifies this popular believe. Gift exchange theory, however, is more encompassing than "explicit" charitable gifts, epitomized by presents given at birthday and Christmas and other momentous events, positing that actually most things in life can be transformed into a gift including intangible goods like knowledge and know-how. Thus the notion of gift exchange is not just limited to charitable gifts – a significant economic phenomenon (Economist, 2006) – nor is the activity as one-dimensional as it may seem at first glance. In terms of motives underlying gift exchange the theory posits that a mixture of motives are involved in giving, ranging, from pure altruism, in a minority of cases, to self-interest. Reciprocity, next to the obligation to give and receive (Mauss, 2000[1954]), exerts a strong influence over members of a community and failure to reciprocate has consequences possibly even resulting in excommunication. Self interest and reciprocity are closely related, though different concepts, allowing individuals to give knowing that they will or 'ought to' receive at some point in time. The extend to which the expectation of reciprocity is conscious is, though theoretically interesting, not so much the focus of this research, as is its effectiveness and importance as a mechanism for exchange.

Thus in line with theory this dissertation is developed from the notion that, gift exchange is omnipresent, yet the generosity and voluntarism usually associated with gift giving oftentimes is an illusion (Blau, 1964; Mauss, 1954). Even when altruistic motives play a role, these tend not to be unrelated to the motive of self interest as gifts foster good reputation, gratitude and return gifts. Even more to the point may be Putnam's (2000) characterization of gifts as short-term altruism for long term self-interest.

1.3 Contribution to literature

Innovation has long since been considered of great important for productivity growth, constituting a considerable if not key competitive advantage for firms and nations alike. Although considered important by many economists (Schumpeter, 1934, Hayek, 1937, 1945; Penrose, 1959) systematic and empirical innovation studies didn't took off until the 1960's. Initially, adoption or diffusion of innovation represented the focus of much research. Within this context, social network analysis (SNA) contributed significantly by examining the role of different elements of network structure in explaining innovation processes and outcomes, both on a macro and micro level (Coleman, Katz, and Menzel, 1966; Gabbay & Zuckerman, 1998; Galunic & Moran, 2000; Hansen, 1999; Landry et al., 2002; Nahaphiet & Ghosal, 1998; Allen & Cohen, 1969; Allen, 1977; Tushman, 1978; Tushman & Scalan, 1981; Burt, 1992, 2004).

Concomitant with a growing interest for innovation, organizational scholars began to view knowledge as an organization's most strategic resource (Conner & Prahalad, 1996; Kogut & Zander, 1996; Nahapiet & Ghosal, 1998; Osterloh & Frey, 2000) and knowledge

creation and transfer fundamental to its performance (Davenport & Prusak, 1998; Tushman, 1977; Moorman & Miner, 1998; Perry-Smith & Shalley, 2003; Tsai, 2001; Moran, 2005, Hansen, Mors & Lovas, 2005). Knowledge transfer's pivotal role in knowledge creation is well documented in literature enabling combination and recombination processes essential for innovation (Cohen & Levinthal, 1990; Kogut & Zander, 1992; Moran & Ghosal, 1996; Nahapiet & Ghosal, 1998; Tsai & Ghosal, 1998). However, as documented by an extensive body of literature knowledge transfers in organizational contexts are anything but automatic (Szulanski, 1996; Argote, 1999; Hansen, 1999; Reagans & McEvily, 2003). Social network analysis can and does offer insights into knowledge transfer as it explores different types of intra-organizational networks or relations (Levin & Cross, 2004; Hansen, 1999; Allen, 1977; Burt, 1992; Rogers, 1995) but has focused almost exclusively on structural aspects of relations between individuals. This focus seems partial as structural aspects only go so far when it comes to exploring the motivational drivers behind knowledge transfers between individuals. This observation is in line with a number of authors, who conclude that the micro processes or social dimensions of knowledge sharing in the innovation development process need further exploration (Tsai, 2000; Kim & Mauborgne, 1998; Darr, Argote & Epple, 1995; and particularly Obstfeld, 2005).

In order to explore the 'micro processes or social dimensions' in knowledge transfers this study introduces the *concept* of gift exchange from the field of anthropology, as a means of creating and maintaining social ties. Transfers of knowledge are envisioned as gift exchanges between actors. Theoretically, this thesis connects gift exchange literature to the innovation and knowledge transfer literature streams. Gift exchange literature allows us to explain why individuals engage in exchange and as such it offers a more substantive view of relations in knowledge intensive settings. Empirically, the study will investigate the relationship between gift exchange incidence, network positions and innovation performance. At the same time perceived generosity in exchanges, an operationalization of the gift exchange concept, is explored in order to asses whether these differences can be related to performance and gift exchange incidence. That gift exchange theory can be used to explain performance has been illustrated in contexts other than innovation (cf. Flynn, 2003), but these relationships have not been tested empirically for knowledge intensive settings such as R&D labs, where knowledge exchange is both frequent and essential (Harrigan & Dalmia, 1991; Kachra & White, 2008).

1.4 Research question

Organizational literature attests to the vital role knowledge and knowledge creation plays in organizations. Indeed, it is considered a primary driver of organizational performance (Tortotiello, 2006). Generating innovations[18] requires organizations and ultimately the individuals that make up these institutions (Polanyi, 1962; Van de Ven, 1986; Inkpen, 1996; Nonaka, 1994) to utilize existing know-how as well as find and acquire new sources

18 The concepts innovation and knowledge creation are used interchangeably in this dissertation.

of knowledge. Sharing and transferring knowledge between individuals relies on social structure as it provides the conduits through which knowledge flows (Podolny, 2001; Tsai & Ghosal, 1998; Owen-Smith & Powell, 2004). Put differently, knowledge in organizations is held at the individual level and expressed in the cooperation of members in social communities (e.g. networks) (Kogut & Zander, 1996). The study of intra-organizational knowledge transfers represent a valuable opportunity to improve our understanding of knowledge activation and sourcing. Knowledge transfers are posited to represent an exchange between individuals with both economic and social utilities. Both exchange aspects may be mutually supportive and are closely associated with the willingness to transfer knowledge. Given the crucial role of networks in finding information and solving problems, and the limited understanding of the motivational drivers behind these transfers, the research question we address in this dissertation is:

- What is the impact of gift exchange incidence and network position on individual innovation[19] performance?

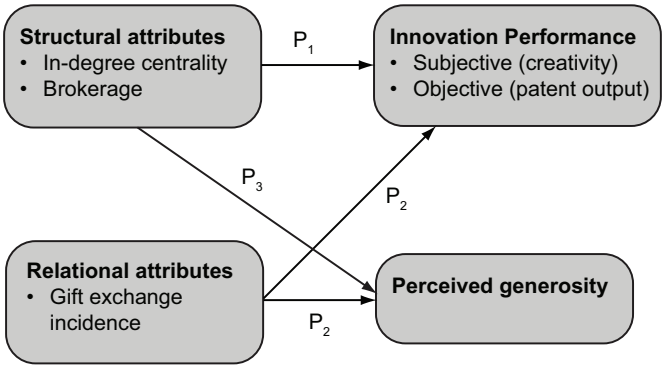
1.5 Conceptual framework

The conceptual framework presented in this section describes the relationships and variables that are essential for this study. As such the conceptual framework is built from concepts and relationships and provides a visual representation of the hypothesized or expected relationships. The framework is based on and extends, as is the nature of research, existing scientific knowledge on the topic of knowledge creation and transfer.

Figure 1-1 shows that innovation performance is hypothesized to be explained by both structural attributes (e.g. network position) (P1), and relational attributes (e.g. gift exchange incidence) (P2). Moreover, this research explores the relationship between perceived generosity and gift exchange incidence (P3). The different expectations visualized by means of different paths within the model, will be formally introduced and put to the test in chapter six.

19 The innovation development process is defined and conceived as an interactive problem solving process involving interpersonal relationships between relevant interdependent actors which may transcend departmental and even organizational boundaries (Landry et al., 2002). It is defined as a process since it may take several consecutive rounds each with its own challenges before an outcome is produced.

Figure 1-1 Conceptual Framework



1.6 Outline of the study

The dissertation consists of *seven* chapters. While the current chapter (*one*) provided the introduction to the study, subsequent chapters explore the concept of exchange in the context of innovation, in line with the research questions of this study. Chapters *two, three* and *four*, are based on three articles, which enquire into the nature and contribution of gift exchange, as set out by the first research question. The empirical study, to a large extent designed in accordance with the second research question, is introduced and results analyzed in chapters *five* and *six*. Reading the theoretical insights offered by chapters two, three and four is not required, per se, in order to understand the empirical part of this study. At the same time, as the theoretical contributions provide the bedrock for empirical results and visa versa, the main contribution of this study lies in the merging of the two scientific realms. Finally, chapter *seven* presents the overall conclusion and implications of the study. Figure 1-2 provides an overview of the different chapters and their respective position within the study. The content of each chapter is shortly discussed below.

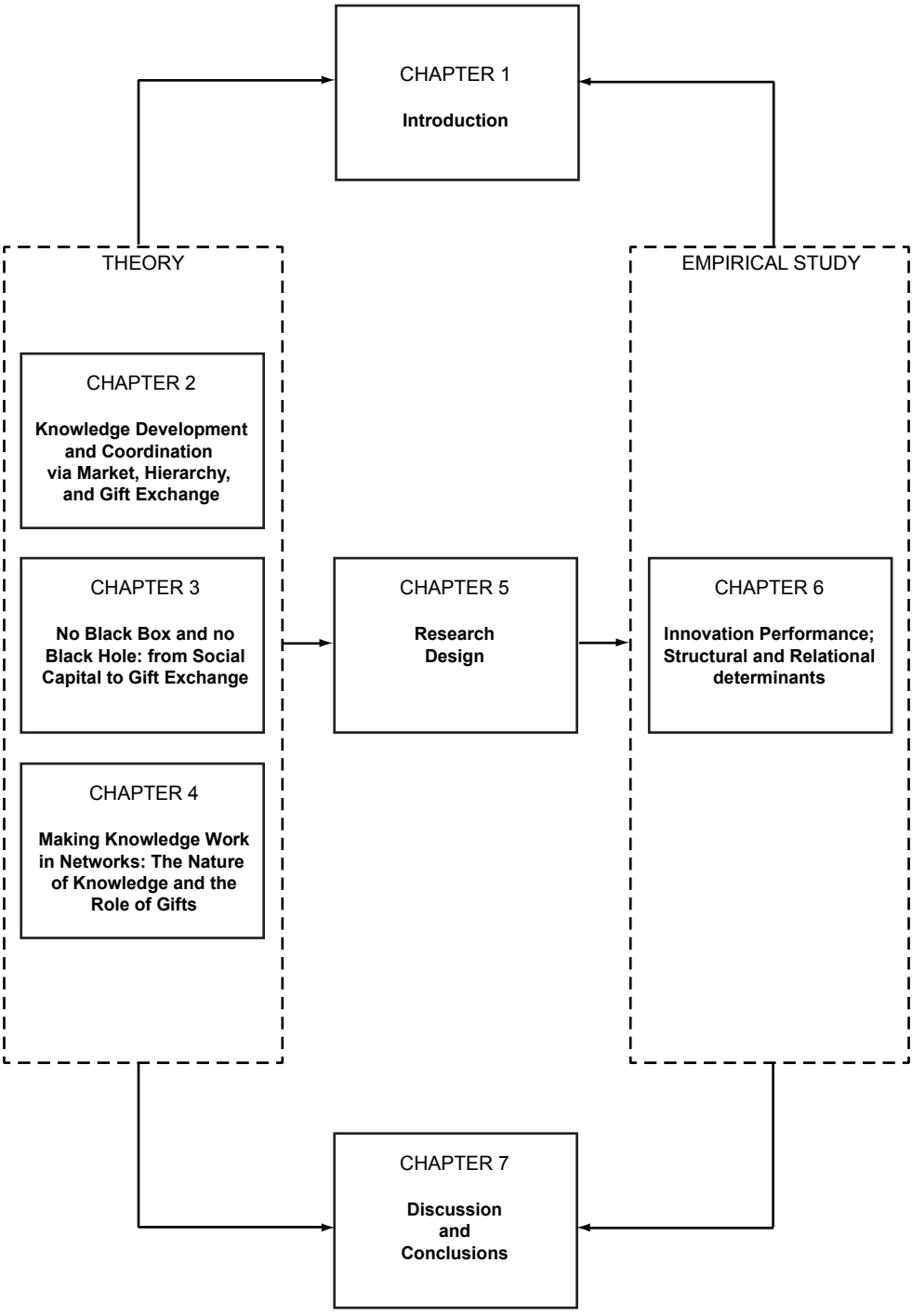
Chapter two, 'Knowledge Development and Coordination via Market, Hierarchy and Gift Exchange', argues to some detail that economic value creation in general and knowledge creation in particular requires coordination. In so doing, the article explores the notion that coordination can take several forms. In addition to an all pervasive market mechanism, where prices coordinate, and hierarchy as epitomized by corporations, where authority coordinates, other forms have been suggested. Some have called these networks, others clans. This chapter suggests that the notion of gift exchange allows for the middle ground between market and hierarchy to be explored more fruitfully. The three coordination mechanisms are assessed in the context of knowledge creation and diffusion. Each has particular advantages, but those offered by gift exchange make it an effective and sometimes preferred alternative.

Chapter 3, 'No Black Box and No Black Hole: from Social Capital to Gift

Exchange', does not elaborate on gift exchange theory and its characteristics as discussed in chapter two per se, as much as it sets out to complement social capital literature with respect to identified theoretical lacunae. A body of literature that notwithstanding its recognition of the (explanatory) value of social relations in many spheres of people's lives underexposes the production mechanisms of social capital. As such chapter three explores relationships between individuals in a community and the cooperation between them. These relations are studied by reviewing the economic and management literature on social capital, supplemented by literature in sociology and anthropology on gift exchange. The use of the word capital in this context is deliberate and means to impart that relationships and social networks are a valuable asset. Social capital represents especially within knowledge intensive environments, a potentially powerful tool for understanding why actors, in knowledge communities (Wenger & Snyder, 2000; Brown & Duguid, 1991, 2001; Nonaka, 1994), continue to interact and cooperate. Yet, for all its explanatory value, social capitals' underlying mechanisms remain underdeveloped. How is social capital created, how is it put to use, and how is it maintained? This chapter uses and develops the literature on gift exchange to develop the concept of social capital further.

In chapter four, titled 'Making Knowledge Work in Networks: The nature of knowledge and the role of gifts', knowledge - in particular both its creation and transfer - is investigated. Theoretically this chapter extends the notions put forwards in chapters 2 and 3 and demonstrates the relevance of interpersonal exchange via gifts/favors in a context of knowledge production. A reality that has been (mostly indirectly) recognized on many occasions in literature but the implications of which are not necessarily understood or investigated. Processes of knowledge transfer within and between firms have been studied from a structural or network perspective extensively. It is a central theme in the knowledge management literature. The social network literature however, faces an 'action problem'. Focusing on structural elements such as an agent's position in a network and the types of relations entertained cannot explain why actors actually exchange knowledge. This is a particularly pertinent question for the exchange of knowledge, given that it is elusive. The exchange of it can easily be avoided. This chapter argues that the concept of gift exchange, explains why some agents do and others don't exchange knowledge with each other. Gift exchange – following Mauss' dictum to "give, receive and reciprocate" – establishes obligations which explain why relations are established, persist, end, and particularly are actually used.

Figure 1-2 Overview of the Study



Chapter five, 'Research Design', lays out the research design of the empirical study. The study's multilevel research design, incorporating both qualitative and quantitative elements, and the associated benefits, is explained and justified. After which a description of the research setting, or the context of the study if you will, is provided. Finally, this chapter expounds the main variables of the study and addresses matters of validity and reliability. As such, this chapter bridges the conceptual and empirical parts of this study and provides a stepping stone for chapter six' empirical expose.

Subsequently chapter six, 'Innovation Performance: Structural and Relational Determinants', applies both descriptive and inferential statistics, prefaced by qualitative observations, in order to probe the validity of the proposed relationships. A critical assessment of the exchange and innovation performance relationship follows. Next determinants of perceived generosity are established and explored providing a broader context in terms of gift exchange's effects. Results, both expected and unexpected, indicate that actors' structural and relational attributes are tied to several outcome variables.

Finally chapter seven, 'Discussion and Conclusions', presents the overall conclusions of this study. Theoretical and practical relevance of the research findings are reviewed. This review is concluded by an outline of the limitations of this study as well as research directions for future research.

References

Adler, P.S. (2001) 'Market, Hierarchy, and Trust : The Knowledge Economy, and the Future of Capitalism', *Organization Science* 12(2): 215-234.

Allen, T.J. (1977) *Managing the flow of technology: Technology Transfer and the dissemination of technological information within the R&D organization*. Cambridge MA: The MIT Press

Allen, T.J., & Cohen, S.I., (1969) 'Information flow in research and development laboratories', *Administrative Science Quarterly*, 14, 12-19

Amabile, T.M. (1988) 'A model of creativity and innovation in organizations', *Research in Organizational Behavior* 10: 123-167.

Ancona, D., & Caldwell, D. (1987). Management issues facing new product teams in high technology companies. In: D. Lewin, D. Lipsky, & D. Sokel (Eds.), *Advances in industrial and labor relations*, 4: 191-221. Greenwich, CT: JAI Press.

Appleyard, M.M. (1996), 'How does knowledge flow? Interfirm patterns in the semiconductor industry.', *Strategic Management Journal*, Winter Special Issue, 17: 137-154

Argote, L. (1999), *Organizational Learning. Creating, Retaining and Transferring Knowledge,* Norwell, MA: Kluwer Academic Publishers.

Arrow, K.J. (1984) 'Information and economic behavior', In: *Collected Papers of Kenneth J.Arrow,* Vol.4., Belknap Press, Cambridge, MA.

Avner, O. (1997) 'Between the Gift and the Market' Economic History Review 50(3): 450-476.

Blau, P. (1964) Exchange and Power in Social Life. New York: Wiley

Bourdieu, P. (1986), 'Forms of Capital', In: Handbook of Theory and Research for the Sociology of Education., Ed. Richardson, J. G. , New York: Greenwood Press.

----, (1977) Outline of a Theory in Practice. Cambridge UP: Cambridge

Bouty, I. (2000) 'Interpersonal and interaction influences on informal resource exchanges between R&D researchers acrros organizational boundaries' Academy of Management Journal 43(1): 50-65

Brown, J.S. & Duguid, P. (1991), 'Organizational Learning and Communities of Practice' Organization Science 2(1): 40-57

----, (2001) 'Knowledge and Organization' Organization Science 12(2): 198-213.

Bullock, A. & Trombley, S. [ED.]. The New Fontana Dictionary of Modern Thought. London. HarperCollins Publishers. 1999.

Burt, R.S. (1992) Structural holes: The social structure of competition. Cambridge, MA: Harvard UP.

----, (2004) 'Structural Holes and Good Ideas' American Journal of Sociology 110: 442-455

Chesbrough, H. (2003) Open Innovation. Harvard Business School Press.

Clinton, W.J. (2007), Giving – How Each Of Us Can Change The World, New York: Alfred A. Knopf

Cohen, W.M., & Levinthal, D.A. (1990) 'Absorptive capacity' Administrative Science Quarterly 35: 128-152.

Coleman, J.S. (1988) 'Social Capital in the creation of Human Capital' American Journal of Sociology 94 (Suppl.): S95-S120.

Coleman, J.S., Katz, E., & Menzel, H. (1966) Medical Innovations. Indianapolis: Bobbs-Merrill.

Conner, K.R.; Prahalad, C.K. (1996), A Resource-Based Theory of the Firm: Knowledge versus Opportunism. Organization Science; 7, (5), pp. 477-501.

Cross, R., Parker, A., & Borgatti, S. (2001),'Knowing what we know: Supporting knowledge creation and sharing in social networks' Organizational Dynamics 30(2): 100-120

Davenport, T.H. (1997) 'Ten principles of knowledge management and four case studies', Knowledge and Process Management, 4(3), 187-208

Davenport, T.H., & Prusak, L., 'The People Who Make Organizations Go- or Stop', Harvard Business Review, 80(6), 104-112

Darr, A. (2003), 'Gifting Practices and Inter-organizational Relations' Sociological Forum 18(1): 31-51.

Darr, E.D., Argote, L., & Epple, D. (1995) "The Acquisition, Transfer, and Depreciation of Knowledge in Service Organizations" Management Science 41(11): 1750-1762.

Demsetz, H. (1988), 'The theory of the firm revisited. J. Law Econom.Organ. 4(1) 141–162.
Deshpandé, R., Farley, J.U. & Webster, J. (1993), 'Corporate culture, customer orientation and innovativeness in Japanese firms: a quadrad analysis, Journal of Marketing, 57 (1), pp. 22–27.
de Tocqueville, A. (1835) [1988], Democracy in America, New York: Harper Perennial
Dolfsma, W. & R. van der Eijk (2008) "Knowledge Development and Coordination via Market, Hierarchy and Gift Exchange" in: J.B. Davis (ed.) Social Economics. London: Routledge.
Ebers, M. (1999), 'Explaining inter-organizational network formation'. In Ebers, M. (ed.), The Formation of Inter-organizational Networks. Oxford: Oxford University Press, pp. 3-40.
Economist (2006) The business of giving. February 25.
Flynn, F.J. (2003) "How much should I give and how often? The effects of generosity and frequency of favor exchange on social status and productivity" Academy of Management Journal 46(5): 539-
Gabbay, S.M., & Zuckerman, E.W. (1998) 'Social capital and opportunity in corporate R&D' Social Science Research 27(2): 189-217.
Galunic, C., & Moran, P. (2000), 'Social capital and productive exchange', Working Paper Insead 1: 1-31.
Geertz, C. (1973), The Interpretation of Cultures: Selected Essays, New York: Basic Books
Ghoshal, S. & Bartlett, C.A. (1988) 'Creation, adoption, and diffusion of innovations by subsidiaries of Multinational corporations', Journal of International Business Studies 19: 365-388.
Gianmario, V., Prandelli, E., and Sawhney, M. (2006), "Innovation and Virtual Environments: Towards Virtual Knowledge Brokers", Organization Studies, March
Glynn, M.A. (1996), Innovative Genius: A Framework for Relating Individual and Organizational Intelligence to Innovation, The Academy of Management Review, Vol. 21 (4), pp.1081-1111
Granovetter, M.S. (1973) 'The Strength of Weak Ties' American Journal of Sociology 78, 1360-1380.
Hansen, M.T. (1999) "The Search-Transfer Problem" Administrative Science Quarterly 44(1): 82-111.
Hansen, M., Mors, M.L. & Lovas, B. (2005), 'Knowledge Sharing in Organizations: multiple networks, multiple phases', Academy of Management Journal, 48(5), 776-793
Harrigan, K.R. & Dalmia, G. (1991), 'Knowledge workers: the last bastion of competitive advantage', Planning Review, 19(6), 4-11
Hayek, F.A. (1945), 'The Use of Technology in Society', American Economic Review, 35(4), 519-530
Hayek, F.A. (1937), 'Economics and Knowledge', Economica, 33-54
Humphrey, C & Hugh-Jones, S. (1992), Barter, Exchange and Value, Cambridge, UK Cambridge UP.
Huysman, M. & de Wit, D. (2004) 'Practices of Managing Knowledge Sharing" Knowledge and Process Management 11(2): 81-92.
Inkpen, A.C. (1996) 'Creating Knowledge through Collaboration' California Management Review 39(1): 123-140
Janz, B.D., Colquitt, J.A., & Joe, R.A. (1997), 'Knowledge worker team effectiveness: The role of autonomy, interdependence, team development, and contextual support variables', Personnel Psychology, 50, 877-904
Kachra, A., & White, R.E. (2008), 'Know how transfer: The role of social economic/competitive, and firm boundary factors', Strategic Management Journal, 29, 425-445
Keynes, J.M. (1939), 'Professor Tinbergen's Method'', Economic Journal, 49(195), 558—577.
Kim, W.C., & Mauborgne, R. (1998) 'Procedural Justice, Strategic Decision Making, and the Knowledge Economy' Strategic Management Journal 19(4): 323-338
King, G., Keohane, R.O., & Verba, S. (1994), Designing Social Inquiry: Scientific inference in qualitative research. Princeton University Press: Princeton (NJ)
Knight, K.E. (1967) 'A Descriptive Model of the Intra-Firm Innovation Process' Journal of Business 40(4): 478-496.
Kogut, B., & Zander, U. (1992) 'Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology' Management of Technology 3(2): 383-397.
Kreiner, K., & Schultz, M. (1993) "Informal Collaboration in R&D." Organization Studies 14(2): 189-209
Lakhani, K.R., Jeppesen, L.B., Lohse, P.A., & Panetta, J.A. (2006), 'The Value of Openness in Scientific Problem Solving', HBS Working paper 2006-2007 (www.hbs.edu/research/pdf/07-050.pdf)

Landry, R., Amara, N., & Lamari, M. (2002) 'Does social capital determine innovation? To what extent?' Technological Forecasting and Social Change 69: 681-701.
Levin, D., & Cross, R., (2004), 'The strength of weak ties you can trust: The mediating role of trust in effective knowledge transfer, Management Science, 50(11): 1477-1490
March, J.G. & Simon, H.A. (1958), Organizations, New York: Wiley.
Mauss, M. (1954) [2000], The Gift. New York: Norton.
Mokyr, J., (2002), The Gifts of Athena – Historical Origins of the Knowledge Economy. Princeton, NJ.
Moorman, C. & Miner (1998), A.S., 'Organizational Improvisation and Organizational Memory', Academy of Management Review, 23, 698-723
Moran, P (2005) "Structural versus relational embeddedness" Strategic Management Journal 26: 1129-1151
Moran, P., & Ghosal, S. (1996) 'Value creation by firms', Academy of Management Proceedings, 35-39
Nambisan, S., & Sawhney, M. (2008), The Global Brain: Your Roadmap for Innovating Faster and Smarter in a Networked World., New Jersey: Wharton School Publishing
Nahapiet, J., & Ghosal, S. (1998) 'Social capital, intellectual capital, and the organizational advantage', Academy of Management Review, 23(20), 242-266
Nonaka, I. (1994) 'A Dynamic Theory of Organizational Knowledge Creation' Organization Science 5(1): 14-37.
Obstfeld, D. (2005), ' Social Networks the Tertius Lungens Orientation, and Involvement in Innovation', Administrative Science Quarterly, 50, 100-130.
Organization for Economic Cooperation and Development (OECD) (1999), Managing National Innovation Systems. Paris
Organization for Economic Cooperation and Development (OECD) (2001), Science, Technology and Industry Scoreboard: Towards a Knowledge-based Economy, Paris
Osterloh, M. & B. Frey (2000), 'Motivation, Knowledge Transfer, and Organizational Forms', Organization Science 11(5): 538-550
Ouchi, W. (1981). Theory Z. Reading, Massachusetts: Addison-Welsey.
Owen-Smith, J., & Powell, W.W. (2004), 'Knowledge Networks as Channels and Conduits' Organization Science, 15 (1): 5-21
Pearson, K. (1892), The Grammar of Science, New York: Harper and Row.
Penrose, E. (1959), The Theory of the Growth of the Firm. New York: Oxford University Press
Perry-Smith, J.E. & Shalley, C.E. (2003) 'The social side of creativity' Academy of Management Review 28(1): 89-106.
Peters, T.J., & Waterman, R.H. (1982), In Search of Excellence, New York: Harper and Row
Pfeffer, J., Salancik, G.R. (1978), The External Control of Organizations. Harper & Row: New York.
Podolny, J.M. (2001), 'Networks as the Pipes and Prisms of the Market', American Journal of Sociology, 107(1), 33-60
Polanyi, M. (1962), Personal Knowledge. Chicago, IL: University of Chicago Press
Popper, K. (1963), Conjectures and Refutations, Routledge, London.
Putnam, R.D. (2000) Bowling Alone. New York: Simon and Schuster
Reagans, R. & McEvily, B. (2003) 'Network Structure and Knowledge Transfer' Organization Science 13(3): 232-248
Rogers, E.M. (1995) Diffusion of Innovations, New York: Free Press.
Sawhney, M., Wolcott, R., and Arroniz, I (2006). "The 12 Different Ways for Companies to Innovate", MIT Sloan Management Review, Spring.
Sawhney, M. & Prandelli, E (2000), "Communities of Creation: Managing Distributed Innovation in Turbulent Markets", California Management Review, Summer, 24-54.
Schrader, S. (1991), Informal technology transfer between firms: cooperation through information trading, Research Policy, 20, 153-170
Schumpeter, J. (1934 [1978]) The Theory of Economic Development. London; Oxford UP.
Surowiecki, J. (2004). The Wisdom of Crowds: Why the Many Are Smarter Than the Few and How Collective

Wisdom Shapes Business, Economies, Societies and Nations Little, Brown
Szulanski, G. (1996) 'Exploring internal stickiness' Strategic Management 17: 27-43.
Taleb, N. N. (2007) The Black Swan: The Impact of the Highly Improbable. New York: Random House
Tortotiello, M (2006), 'The social underpinnings of absorptive capacity: external knowledge, social networks, and individual innovativeness', Academy of Management Best Paper Proceedings
Tsai, W. & Ghosal, S. (1998) 'Social Capital and Value Creation' Academy of Management Journal 41(4): 464-476
Tsai, W. (2001), 'Knowledge transfer in intra-organizational networks' Academy of Management Review 44: 996-1004
Tushman, M.L. & Scanlan, T.J. (1981) "Boundary spanning individuals" Academy of Management Journal 24: 289-305.
Tushman, M.L. (1977) 'Special boundary roles in the innovation process' Administrative Science Quarterly 22: 587-606.
Van de Ven, A.H. (1986), Central Problems in the Management of Innovation, Management Science, Vol. 32 (5), 590-607
Von Hippel, E. (1994) "'Sticky information' and the locus of problem solving" Management Science 40(4): 429-439.
Walsham, G. (1993), Interpreting Information Systems in Organizations, Wiley, Chichester
Wenger, E., McDermott, R., & Snyder, W., (2002),Cultivating Communities of Practice: a Guide to Managing Knowledge, Harvard Business School Press
Wenger, E.C., & Snyder, W. (2000) 'Communities of Practice the Organizational Frontier' Harvard Business Review, 139-145.
Wenger, E.C. (1998) Communities of Practice. Cambridge: Cambridge UP.
Winter, S.G. & Szulanski, G (2001), 'Replication as Strategy, Organization Science 12(6): 730-743.
Woodman, R.W., Sawyer, J.E., & Griffin, R.W. (1993) 'Toward a theory of organizational creativity' Academy of Management Review 18: 293-321.

Chapter 2
Knowledge Development and Coordination via Market, Hierarchy and Gift Exchange [20,21]

2.1 Introduction

From hunter-gatherer society onwards people in society have experienced the need to cooperate. The need for cooperation, where individuals become dependent on one another, has increased over time as a result of increased ongoing division of labor and specialization. Indeed, as Adam Smith claims, division of labor and specialization have been an important source for economic development. Individuals no longer master the totality of available knowledge and skills and so the need for exchange of resources and cooperation increased. This is acknowledged broadly in economics (Hayek, 1945; Schumpeter, 1934; Nahapiet & Ghosal, 1998), but ill understood in that discipline (Lopes & Caldas 2008). As individuals only have partially overlapping goals and interests, exchange and cooperation needs coordination of some sort (Barnard 1968). By necessity, coordination, be it through the market, in a hierarchy or through some other means of cooperation, requires that not only self interest is relied on, but that shared goals and moral convictions are assumed to exist and play a role (Akerlof 1982, Dolfsma 1998, Le Grand 2003, Lopes & Caldas 2008).

In a world characterized by emerging knowledge economies, intangible assets such as knowledge and information have become increasingly important for economic dynamics (OECD, 2001). Where the conceptualization of coordination of economic activities is problematic even in case of tangibles, in case of a discussion of knowledge creation and diffusion this problem is enhanced. Knowledge has specific properties as a commodity that need to be taken into account when discussing coordination in this context.

This chapter will discuss the three different mechanisms of coordination between actors that have been acknowledged in the literature. A first coordination mechanism is market exchange. Well known among economists, market exchange can be defined as voluntary agreement involving the offer of any sort of present, continuing, or future utility in exchange for utilities of any sort offered in return (Weber 1978). Secondly we can identify hierarchies or bureaucracies, well established as a coordination mechanism at least since Williamson (1975). Here authority, derived from a person's position in an organization, can be used to coordinate. A third coordination mechanism is not as well established. In the literature different terms are used: social relations (Adler & Kwon, 2002), communities (Adler, 2001; Bowles & Gintis, 1998), clans (Ouchi, 1979;1980), (social) networks (Powell,

20 This paper was presented at the World Conference for Social Economics, University of Amsterdam, June 2007; we would like to thank participants to the session for their comments and suggestions, but would like to emphasize that responsibility of the text remains the authors'.

21 This chapter is a revised version of "Knowledge Development and Coordination via Market, Hierarchy and Gift Exchange" to appear in J. Davis (ed.), 2009, Global Social Economy: Development, work and Policy, London & New York: Routledge.

1990; Miles & Snow, 1986; Thorelli, 1986). Despite the different terms and descriptions almost all of these concepts have in common that they describe situations where the coordination between individuals is based on socio-cultural mechanisms instead of market or hierarchy.

The existing literature has examined the merits of market and hierarchy as a means of coordination, but not in the context of knowledge development and diffusion. Given the relevance of innovation in the current economic context, this is a major concern. Social economics is well positioned to address this issue, as it is able to analyze not just the two coordination mechanisms most often analyzed – market and hierarchy – but also to conceptually grasp the middle ground where social relations and social values play a role. Notwithstanding the ideal typical approach that a conceptual discussion takes almost by necessity, these exchange mechanisms may not necessarily be substitutes but can be complements (Akerlof 1982, Bradach & Eccles 1989).

2.2 Ways of Coordinating

In market exchange the presumption is that economic order will emerge from independent, egoistic acts of autonomous individuals in pursuit of their own gain. Hierarchy assumes that the best economic outcome will result from standardization and following the chain of command. A third way, one we shall describe as gift exchange, generally refers to a type of exchange conducted between parties that are characterized by social properties and particularistic ties, the nature of which influences the exchange. In a world with zero transaction costs one may argue that markets as a way of coordinating behavior might be preferable (Coase 1937, Williamson 1975). When transaction costs are present, hierarchy might work better (Hennart 1993; Kreps 1990; Williamson 1975). The literature that has developed to understand hierarchy from an economic perspective may be able to deal conceptually with situations where individuals are boundedly rational, have only partially overlapping goals, and are opportunistic (Williamson 1975). Certainly when discussing knowledge development, and diffusion, however, trust and social norms may play a role too. Understanding how this plays a role may require one to look for ways of coordination where the parties involved are not legally obliged to behave in a certain way because a labor contract specifies it, nor are they involved in a quid pro quo where all relevant goods traded are specified (Arrow, 1972). We will briefly present the different ways of coordinating – markets (A), hierarchy (B), and social relations or gift exchange (C) – and discuss the extent to which they help understand the process of knowledge development and diffusion.

A. Markets

For economists, a perfect market is not an empirical reality but, rather, a set of assumptions: a large number of firms compete in a market for homogeneous commodities to cater to the demand of a large number of consumers. No producing firm or consumer is able to influence the price; all parties have complete knowledge (Stigler, 1968). Markets are where demand and supply meet to set an equilibrium price; all necessary information is summarized in the

prices quoted in a market. Modern economics view the market as a price-setting mechanism and have left its workings implied rather than explicitly discussed (see Barber, 1977; Coase, 1988; Rangan, 2000; Stigler, 1968). Cooperation between actors can take place anonymously; rules of the game are clear to all participants. As Williamson (1975, p.5) puts it "The marvel of the economic system is that prices serve as sufficient statistics, thereby economizing on bounded rationality." In this ideal type of market exchange, the exchange that takes place is de-socialized in nature, it is not "embedded" in a larger social context (Granovetter 1985). In addition it is assumed that exchanges are freely consented to by opportunistic economic actors (Williamson, 1975). Exchange takes place within the context of complete contracts, marginal pricing assures optimized production and allocation and lastly property rights are protected by the state and the appropriate legal institutions. A Pareto efficient situation will result from free and unfettered working of the market; exchange in competitive markets assures that the exchange is equitable.

In the 'pure' market model it is assumed that risk but no fundamental uncertainty is present. If not all possible future states of the world and the likelihood of their occurrence are known, there is a situation of fundamental uncertainty. Certainly in such a situation complete contracting is impossible. Prices are likely not to reflect the true value of the commodity exchanged and/or prices do not contain all relevant information (Hennart, 1993). One may characterize such situations as market failure, and economists do so. The term implies that markets may be made to work in these situations. One may also claim that a different mechanism is at work.

Knowledge and the Market

Many firms make use of the market mechanism to develop and procure relevant knowledge. In the year 2000 $142 billion was paid internationally by users to parties that owned intellectual property rights (IPRs) in order to make use of knowledge that was legally protected under IPR Law (Dolfsma, 2006). The IPR system thus allows for a market that coordinates the exchange of knowledge. Knowledge as a commodity to be exchanged on the market is no ordinary good. It is non-rivalrous: it is not consumed by their use (Adler, 2001; Arrow, 1984), and non-exclusive: consumption or use by non-payers cannot be excluded. Knowledge is a (quasi) public good – reliance on the market creates a trade-off between production and allocation. The market may not stimulate the creation of new knowledge in amounts that are beneficial for society (Alder, 2001; Stiglitz, 1994; Nelson, 1959; Romer, 2002). If knowledge is available in an explicit form, and possibly digitized too, it can be very easily copied by others (Soete & ter Weel 2005; Cowan, David & Foray 2000).

Knowledge development is cumulative, though the extent to which this is true differs across fields. New knowledge is for the most part based on (related) work done by others (in the past): we stand on the shoulders of giants (and dwarfs). One of the conditions conducive to scientific progress thus is "open research" or the full and free dissemination of research results (Nelson 1959). However, from the perspective of the party that invested in the generation of new knowledge, the notion of "open research" may be unappealing since it increases the risk of not recouping initial investment.

Furthermore, Grant (1996) points out that for knowledge creation, but less so for knowledge diffusion, due to the far-reaching extent of specialization, the coordinated effort of many individual specialists and organizations of different kinds is needed. Market are at a significant disadvantage when it comes to performing this coordinating role. Because they address actors as motivated by extrinsic benefits, markets may actually increase the risk of opportunistic behavior (Le Grand 2003; Grant 1996). Thus, while markets as a means of coordinating behavior for knowledge development and diffusion are not to be dismissed, neither are they to be relied on exclusively.

B. Hierarchy

Transaction cost theory (Coase, 1937; Williamson, 1975) stresses that to transact actors involved incur costs – transaction costs – other than those needed for the good or service exchanged. These transaction costs are costs of coordination, and include costs of contract drafting and contract enforcement. According to transaction cost theory, transactions may take place either in the market or in a hierarchy (firm, organization) – these are the two alternatives. Given the type of transaction (for instance its frequency, investments required, number of competitors faced, duration of the contract), and the characteristics of the good involved, transaction costs will differ (Hennart, 1993; Krebs, 1990; Williamson, 1975).

By seeking to explain what type of activities need to be left to the market, and which need to be brought within the domain of the firm, transaction costs theory endogenizes the boundaries of the firm. Hierarchies coordinate the activities of individuals through the use of authority (legitimate power) aiming at some organizational goal (Williamson 1975; Ouchi 1979, 1980; Adler 2001; Adler & Kwon 2002). The organization uses authority to set rules and issue directives with regard to processes completed or standards of output or quality (Grant, 1996; Ouchi, 1979). Members must abide by the rules and directives. Surveillance and direction of subordinates are employed by hierarchy to ensure that rules are followed, which involves a cost on its own (Hennart 1993; Ouchi 1980). A perception of equity about the coordination in a hierarchy is the result of social agreement that the hierarchy has the ability and the right to value each contribution and reward it fairly (Ouchi, 1980). Hierarchy may be efficient especially in case of a complex situation where the activities of multiple specialized units and large numbers of people need to be coordinated (Grant 1996; Jacques 1990; Romme 1996).

Hierarchy's costs are associated with measuring performance. When "tasks become highly unique, completely integrated or ambiguous for other reasons" performance may be impossible to measure (Ouchi, 1980; Adler, 2001). Certainly when the counterfactual – the outcome that could have resulted had someone acted in line with the interests of the hierarchy rather than her own – is impossible to determine, performance of hierarchy members cannot be determined. This is obviously the case when new knowledge is (not) created or diffused. Hierarchies may offset performance measurement problems when an incomplete employment contract allows for providing directions on a day-to-day basis and almost casual monitoring as a by-product.

As Homans (1950) has argued, however, when people work closely together within

a organization an atmosphere of trust and goal congruence results. Opportunistic behavior and therefore the need for monitoring are reduced. Hierarchies can create an 'atmosphere of trust' since they not only provide the stability of long-term cooperative relationships but also employ socialization to create goal congruence and a sense of shared destiny and belonging (Ouchi, 1979, 1980; Adler, 2001; Grant, 1996). Thus, hierarchies permit parties to deal with uncertainty/ complexity in an adaptive sequential fashion. While it may be argued that an atmosphere of trust is more likely to grow within hierarchy than in the market, trust may be established between parties in the market as well (Van der Eijk, Dolfsma & Jolink 2006). What is more important to observe, conceptually, is that the emergence of trust within hierarchy is not taken into account in transaction costs theory.

Knowledge and Hierarchy

To coordinate, hierarchies create horizontally and vertically differentiated units to divide labor. Such organizational structuring may be especially efficient when performing routine tasks but encounters difficulty in case of creation of new knowledge (e.g. Mintzberg, 1979, Scott, 1992; Adler, 2001). Hierarchy coordinates by centralizing information. However, centralizing information functions effectively only if information is "characterized by a high degree of confirmation and little novelty" (Romme, 1996) and is not tacit in nature (Grant, 1996). Managers may not be able to coordinate and absorb the knowledge their experts have mastered. Knowledge also gives rise to performance measurement difficulties (Adler, 2001). According to Adler (2001) vertical differentiation performs well in facilitating downward communication of explicit knowledge and commands, but is less effective in facilitating upward communication of new ideas and knowledge. Hierarchy may thus be an obstacle to learning. Learning might instead require team-like, non-hierarchical structures (Iannello, 1992; Levinthal & March, 1993; Peters, 1987; Senge, 1990; Romme, 1996). As Powell et al. (1996, p.118) point out "Knowledge creation occurs in the context of a community, one that is fluid and evolving rather than tightly bound or static. The canonical formal organization, with its bureaucratic rigidities, is a poor vehicle for learning".

Direct horizontal communication between the relevant experts in different units might compensate for hierarchy's difficulty in facilitating upward communication of new ideas and knowledge needed for coordination. However, horizontal differentiations within hierarchies makes cooperation with regard to knowledge creation between units difficult, because units oftentimes have different goals, priorities, working procedures or even locations depending on the needs and circumstances that they face that make direct, horizontal (informal) contact between experts difficult. What is more, even though formal structure is able to stimulate knowledge development and diffusion, imposing directives to be creative is not likely to work well. Coordination of knowledge development activities often requires a more 'personal' kind of interaction between experts rather than managers than can be achieved by means of rules and directives (Galbraith 1973; Grant 1996; Hansen, 1999; Kogut & Zander 1992).

Galbraith (1973) points out that information processing within the hierarchy besides the formal vertical linkages oftentimes takes place via informal horizontal linkages.

In this connection, Romme (1996) points towards the importance of teams for knowledge production. Brown and Duguid (1991) emphasize that knowledge creation takes place within the context of an informal community which generally spans departmental and even organizational boundaries. Given the informal nature of many of these horizontal linkages and exchanges, the employment of authority as hierarchy's central coordination mechanism is impaired. This, however, does not prevent horizontal knowledge exchanges from taking place. What in the absence of hierarchy and the market mechanism, whose rigidities are considered a poor vehicle for learning, coordinates these exchanges?

C. Social Relations: Gifts

A number of scholars have proposed alternative ways of coordinating the behavior of actors. Sometimes these are presented as 'in-between' markets and hierarchies to be analyzed in similar terms, sometimes they are posed as alternatives in their own right. Terms such as social relations (Adler & Kwon 2002), communities (Adler 2001; Bowles & Gintis 1998), clans (Ouchi 1980) and networks (Powell 1990; Miles & Snow 1986; Thorelli 1986) have been introduced. Most of these conceptions have a common aim to coordinate by curbing the effects of opportunism and goal incongruence using social and/or cultural mechanisms such as trust (Adler, 2001; Bradach & Eccles, 1989; Nooteboom, 2002), common values and beliefs (Ouchi, 1980; Granovetter, 1985) or network and reputation effects (Powell, 1990; Nooteboom, 2002).

Coordination through both hierarchy as well as through the market can fail, especially as we have argued in the context of knowledge development and diffusion (innovation). Coordination does not need to be formal either in terms of (labor) contracts and directives, however (Ouchi 1980; Scott, 1992), as informal mechanisms of coordination can provide an alternative. Trust, the expectation that the exchange partner will act honestly and in good faith (Ring & Van de Ven 1992), can alleviate fears of opportunistic behavior and as such has been compared to a lubricant to both social and economic activity (Arrow 1974). Economic transactions that might otherwise prove extremely costly and time consuming to arrange, or involving extensive use of bureaucratic procedures to supervise, are undertaken in informal settings. Values and beliefs held in common – a 'culture' in the anthropological sense of the term – by a community will allow for and support such informal dealings. A national context, social stratification as well as a group or organizational culture can be involved, even when each can prevent trust from emerging in the informal setting. Common values and beliefs become internalized via socialization and habituation partly in the form of tacit knowledge (Hofstede, 1991; Schein, 1992; Rousseau, 1990), and are associated with shared representation and systems of meaning among parties (Cicourel, 1973; Rousseau, 1990; Schein, 1992; Allaire & Firsirotu, 1984). Common agreement between individuals about what constitutes proper behavior and a sense of solidarity or common destiny reduces goal incongruence. While usually not explicitly for that purpose , the tendency for opportunistic behavior and thus the need for monitoring are thereby reduced, sometimes reduced significantly. While Ouchi (1980) emphasizes the ability of the organization to employ

common values and beliefs as a result of socialization, coordination on the basis of informal and socio-cultural mechanisms can also take place across organizational borders (e.g. Allen, 1977; Allen & Cohen, 1968; Kreiner & Schultz, 1993; Von Hippel, 1987; Agrawal et al., 2003).

Social relations and gift exchange as a third coordination mechanism beside market or hierarchy is not as much explored even when there are some suggestions (Ouchi 1980; Powell 1990; Van der Eijk, Dolfsma & Jolink 2006). Table 1 summarizes some of the main features of each of these three coordination mechanisms. We will elaborate on this further below in the context of knowledge development and diffusion. What needs to be acknowledged, however, are the interconnections and interactions between mechanisms discussed as ideal types here (Williams 1988; Nooteboom 2000, 2002; Parsons 1951; Shapiro 1987).

Table 2-1 Coordination Mechanisms

Dimension	Market	Hierarchy	Social relations / Gift exchange
What is exchanged?	Goods and services for money or barter	Obedience to authority for material and spiritual security; time in return for some type of monetary compensation	Favors / gifts: tangible (goods/ money) and intangible (information/services/love/ status) (Foa & Foa 1980)
Specific or (deliberately) unclear terms of exchange	Specific	Unspecified, open (employee will follow directives within general limits of law and of morality.)	Deliberately unclear (A gift/ favor creates an obligation to reciprocate; however, the value, form and timing of the counter gift is left open to discretion [van der Eijk et al. 2006])
Expected individual orientation	Self-interest	Subordination to directives and rules	Reciprocity, social obligations (vertical & horizontal)
System regulation	Self-regulation; contract law, property rights	Organizational procedures; third party arbiters; labor law	Reputation effect; benefits of continued cooperation; hostages; moral norm of reciprocity; norms and social solidarity; network closure.

Adapted from Adler & Kwon (2002), Biggart & Delbridge (2004), Bugental (2000), Fiske (1992), Ouchi (1980) and Powell (1990).

Thus, individuals may be motivated by, or addressed as having, egoistic or other-oriented considerations. Other-oriented considerations might be altruistic ones, but need not be solely directed at the well-being of others. Similarly, coordination of the actions of individuals might be through concrete persons or take an impersonal route through directives and rules developed explicitly. Coordination through the market as well as through hierarchy has been conceptualized generally as involving actors that are egoistically motivated where coordination takes the route of impersonal interaction. In Table 2, both market and hierarchy are to be found in Cell I only. It should be noted that also social and personal interaction can be egoistically motivated. As has been argued by social scientists since

the classical anthropologists Mauss and Malinowsky, social interaction and gift exchange involves egoism, power struggles, as well as altruism (see also Bugental 2000; Williams 1988; Sherry 1983; Komter, 1996; Vandevelde, 2000) ; it can be highly personal involving strong ties but also impersonal as in cases where immediate personal relations are absent and actors address (unknown) others. Social relations and gift exchange thus encompasses Cells II through IV. Coordination through gift exchange can thus complement the market and hierarchy as a means of coordination. For instance, in a context where the value and belief system emphasizes the moral significance of reciprocity, gift exchange may need to depend less on calculative self-interest to coordinate.

Table 2-2: Coordination Dissected

	Sources	
Motivation	**Impersonal**	**Personal**
Egoistic	I - Sanctions imposed by authority; contractual obligation	II - Calculative self-interest; benefits of continued cooperation (Abreu 1998; Telser 1980; Axelrod 1984; Hill 1990; Heide & Miner 1992; Parkhe 1993); reputation (Weigelt & Camerer 1988; Kreps 1990; Coleman 1990); hostages (Williamson 1985)
Other-oriented	III - Norms, value and belief systems, ethics(Porter & Sensenbrenner 1998; Nye 1979; Hofstede 1991; Schein 1992)	IV - Relations of affect; routines, habituation; empathy

Adapted from Willliams (1988) and Nooteboom (2002)

Gift exchange known for its role in establishing social ties or maintaining relationships (Cheal 1996; Darr 2003; Mauss 1954; Gouldner 1960; Larsen & Watson 2001; Belk 1979; van der Eijk et al. 2006), despite the presence of possible ulterior motives (Sherry 1983). As exchange continues, positive emotions are generated and uncertainty is reduced which, in turn, generates cohesion and commitment to the exchange relation (Lawler et al. 2000; Homans 1958). As both Granovetter (1985) and Homans (1950) argue: what may have started out as a purely goal-oriented interaction tends to become embedded over time in social trust relations. These relations of affect can act as a source of cooperation and exchange (Coleman 1988; Ingram & Robert 2000). Altruistic behavior can result from routines and habituation, as can be argued even from a behaviorist psychological point of view. Operant conditioning in exchange, i.e. behaviors that are reinforced by rewards, are more likely to be repeated over time (Homans 1958, 1974). Behavior that becomes a routine, or non-reflective and tacit in nature, can continue even when the behavior is no longer reinforced by (immediate) rewards (Homans, 1958, 1974).

Some social mechanisms such as expected benefits of continued future cooperation, hostage and reputation effect, emphasize the egoistic element to social interaction by focusing on the incentive structure participants face when deciding to honor their obligations. The latter of these is one of the less egoistic mechanisms, and may be on the boundary of self-

interested and other-oriented, indicating the difficulty of distinguishing them conceptually or empirically. In a situation where the focal actor and the recipient are part of atriad (Simmel, 1964), given that the reputation effect is sufficiently strong, the incentive structure can be structured in such a way that calculative self-interest makes honoring debts rational (Krebs, 1990; Ostrom & Ahn, 2003; Coleman, 1988; Sherry, 1983; Ferrary, 2003; Gouldner, 1960). As Williamson (1975. p.107) formulates it in a rare instance where he acknowledges the social in the economic realm: "Individual aggressiveness is curbed by the prospect of ostracism among peers, in both trade and social circumstances". By the same token if one has a reputation for generously compensating those who have helped you, one will induce others to do you favors. ([Barney & Hansen, 1994] taken from Rose-Ackerman, 1998). In the literature on gifts, this is known as the Matthew Effect: those who have shall be given to. This may lead to a situation where those who do not have are ex-communicated. Nevertheless, as the value of a gift is defined within a specific context, the deleterious effects may be more limited than in cases where action is coordinated by the market or by hierarchy. In any case the Matthew Effect is an effect that is well-documented in how science develops as well (Merton 1968).

2.3 Knowledge and Gift exchange

We submit that exchange outside of market and hierarchy is predicated on gift exchange (e.g., Akerlof, 1982; Blau, 1964; Boulding, 1981 ; Heath, 1976; Homans, 1974; Mauss 1954; Sherry, 1983), and involves actors, resources and structures (Molm, 2003). Gift exchange is omnipresent and not just limited to charitable ('altruistic') gifts. It is a significant economic phenomenon (The Economist, 2006). Gift exchange allows for the exchange of both tangible goods as well as intangible goods.

Gift exchange has a number of properties that differentiate it from other forms of coordination. Firstly, according to the norm of reciprocity an individual is obliged to give, to receive and to reciprocate (Gouldner 1960; Levi-Strauss 1996; Malinowski 1996; Mauss 1954; Sahlins 1996; Schwartz 1996; Simmel 1996). The imperative nature of this three-fold obligation derives from its cultural embeddedness (Sherry 1983). Gift exchange is carried out without a legal contract, even in business settings (Darr 2003; Ferrary, 2003), but does create strong obligation to reciprocate (Gouldner, 1960; Levi-Strauss, 1996; Malinowski, 1996; Mauss, 1954; Sahlins, 1996; Schwartz, 1996; Simmel, 1996). Those who cannot or will not reciprocate are no longer part of the community or are subordinated. Gift exchange gives rise to a psychological contract between the giver and givee (Schein, 1965). Acceptance of the gift is, to a certain extent, acceptance of the giver and the relationship between the parties (Larsen & Watson 2001; Carrier 1991). Gifts valued highest tend to be those where a personal element is involved – it is for this reason that the material value of a gift is often hidden from direct view, though not unappreciated, especially between actors that know each other and are close. By the same token the refusal of the initial gift marks the refusal to initiate the dynamic of exchange, thus to refuse a gift is to refuse a relationship (Ferrary 2003; Mauss 1954).

Second, the nature of the countergift is not specified beforehand - reciprocity is open to discretion as to the value, the form and the moment of occurrence of the counter gift (Bourdieu 1977; Gouldner 1960; Mauss 1954; Deckop et al. 2003). Schwartz (1996) states that it is even prohibited to make an equal-return 'payment' (homeomorphic reciprocity) in gift exchange since this is tantamount to returning the offered gift to the donor – in the context of knowledge development returning the same good makes no sense as knowledge has public goods characteristics; at the same time paying for a gift of knowledge in a social context of trust negates the personal element and symbolically ends the relation. Many scholars emphasize that the return gift should ultimately, over the longer term be of roughly equal value, even when equivalence is context dependent and defined by the actors involved (Gouldner, 1960).

Thirdly, the diachronous nature of the exchange means that the gift is not reciprocated by immediate compensation, but instead by a deferred form of return (Mauss 1954; Bourdieu 1977; Ferrary 2003; Deckop et al. 2003). A deferred return obligates one individual to another, and thus creates a social debt. As a coordination mechanism it thus operates through time, making it particularly useful for knowledge development and the circumstances in which it flourishes.

Gift exchange coordinates exchange by interlocking personal and impersonal sources of coordination based on both egoistic and altruistic motivation, enabling exchange in circumstances where the market and hierarchy cannot (Ferrary 2003; Smart 1993). Some have argued that gift exchange may be the only type of exchange to develop specific commercial products – open source software being a case in point (Zeitlyn 2003). The literature generally stresses that there is a propensity to give, yet there also is a need for equity (Adams 1965; Deckop et al. 2003; Gouldner 1960; Maitland 2002; Walster et al. 1973). Reciprocity is essential to this conceptualization, since an initial gift creates an informal obligation to reciprocate in due time or when needed (Gouldner 1960; Levi-Strauss 1996; Malinowski 1996; Mauss 1954; Sahlins 1996; Schwartz 1996; Simmel 1996) and has been characterized as short-term altruism for long-term self-interest (Putnam 2000: 134). Much of gift exchange's effectiveness hinges on the force of the felt need to reciprocate, internalized or socially imposed, considering that the value, form and moment of the counter-gift is not specified before hand.

It has been argued that intellectual objects more often than physical ones are the result of cooperation (Bowles & Gintis, 1998; Dolfsma, 2008). Some consider knowledge creation as equivalent to combination, exchange and recombination of existing knowledge (Schumpeter, 1934). In that sense knowledge development is a cumulative process (Nelson, 1959; Nelson, 2004) where scientists must necessarily draw on the work of others. Moreover it oftentimes requires the integration of the specialized knowledge of multiple individuals (Grant, 1996), and as such collaborative teamwork, cooperation and knowledge sharing become essential (Adler, 2001; Moran & Ghosal, 1996; Nahapiet & Ghosal, 1998; Tsai & Ghosal, 1998). At the same time, coordination via the market and hierarchy was shown to be difficult when dealing

with knowledge. Partly because the outcome of the innovation process is fundamentally uncertain, the viability of use of contracts is limited: detailed rights and obligations for all possible future scenarios is prohibitively difficult and thus costly (Nooteboom, 2002). Even when drafting elaborate contracts is still just feasible technically, such contracts may undermine the trust necessary for knowledge development (Klein Wolthuis, Hillebrand & Nooteboom 2005). Monitoring activities during the process of knowledge development may be difficult too; indeed, establishing the quality of the knowledge developed after it has been created may be difficult, even ex post. The linear model of developing knowledge, where a separate group of individuals is to develop knowledge until it is ready and then to pass it on for design of a product that will be sold in the market, is obsolete. Knowledge development is a perpetual process, and the market does not offer definitive tests ex post of the usefulness of what is developed. There is more involved, thus, than a situation of asymmetric information and a problem of determining what is the individual contribution to a group outcome.

For anything more that the very minor adaptations of existing goods and processes, actors will resort to an alternative coordination mechanism, at least in part. The generation and diffusion of knowledge depends to a very large extent upon 'communities' (Brown & Duguid 1991; Cohendet et al. 2004). These communities are made up of (oftentimes) informal networks and ties (Freeman 1991; Cross et al. 2002; Madhaven & Grover 1998). Gift exchange provides such an alternative perspective on coordination.

A number of features of gift exchange are especially relevant when dealing with and engaging in the exchange of knowledge based assets: decentralization of monitoring, provision of incentives for knowledge sharing on an individual level, and a guide to knowledge exchange within and across organizational boundaries.

Monitoring. One striking feature of gift exchange is that coordination occurs in the absence of a centralized structure capable of making decisions binding on its members. When "tasks become exceedingly unique, fully integrated, or ambiguous for other reasons, then even bureaucratic mechanisms fail" (Ouchi 1980, p.134). However, performance ambiguity on an organizational level does not necessarily equate to performance ambiguity on an individual level. As coordination via gift exchange generally takes place on an individual level, the need to monitor is effectively decentralized to that individual level. Given that actors are generally more capable of monitoring and valuing one another's performance, gift exchange can coordinate in the face of extensive performance measurement difficulties.

Motivation. For coordination of behavior to be effective, the willingness of the actors involved to engage is required. This is especially relevant within the context of innovation since "knowledge sharing cannot be forced; people will only share knowledge if there is a personal reason to do so" (Huysman & de Wit 2004). For coordination between individuals in the context of innovation to be effective there must thus be an intent or willingness, in addition to the ability, to share relevant knowledge (Hansen 1999). The willingness issue is especially relevant, though infrequently analyzed, considering the costs and uncertainty

associated with sharing knowledge in terms of time, energy, and vulnerability on the part of the donor (Reagens & McEvily, 2003). The actor's position is vulnerable as redundancy increases, competition from the givee may result and a countergift may not materialize (Davenport 1997; Reagens & McEvily 2003).

Yet, despite the possible costs from the donor's perspective, knowledge continues to be shared (e.g. Wenger & Snyder 2000; Wenger 1998; Brown & Duguid 1991; 2001). Why do individuals, in the absence of clearly defined, formal, enforceable obligations or contracts, continue to provide recipients with knowledge? Gift exchange provides the parties involved with a context for the exchange of resources, as well as a socially embedded informal sanctioning or enforcement mechanism. Gift exchange incorporates altruistic as well as more self-interested motives, of which the latter are generally emphasized. The act of giving creates obligations, which the giver can draw on in the future (Coleman 1988; Mauss 1954; Bourdieu 1977). The givee owes the giver, at some point in the future, something of similar value, depending on the rituals for giving within the relevant group (Avner 1997; Blau 1964; Bourdieu 1977, 1986; Humphrey & Hugh-Jones 1992; Darr 2003). At the same time, through giving, a reputation can be established and accumulate which can provide prestige and standing as well as ease of access to resources held by others. A reputation for generosity or trustworthiness can be a valuable asset (Bourdieu 1977).

Access to knowledge within and between organizations. Horizontal differentiations or departmentalization within hierarchies makes cooperation with regard to knowledge creation between units difficult, firstly because units have different knowledge bases, and secondly, because units often have different priorities (Adler 2001). Cooperation required for knowledge development requires participation of specialists, not merely as a result of the tacit nature of much knowledge (Burt 2004; Grant, 1996; Hansen, 1999; Kogut & Zander, 1992). Coordination of tasks related to knowledge development requires a more "personal" interaction than can be achieved by means of rules and directives (Gailbraith, 1973), even when the formalized interaction should not be underestimated (Aalbers et al. 2006). Galbraith (1973) argues that information processing within the hierarchy often bypasses vertical linkages, taking place via informal (horizontal) ties. Romme (1996) points to teams for knowledge production. Brown and Duguid (1991) emphasize that knowledge creation takes place within (informal) communities of practice which may span across departmental and even organizational boundaries. Given the informal nature of many of these linkages, the use of authority as the central coordination mechanism within a hierarchy is impaired.

Gift exchange can enable knowledge exchange in circumstances where the market and hierarchy cannot (Ferrary 2003; Smart 1993) since it allows actors to forge and personalize relationships and to develop personal ties that can act as a 'guarantee' that their initial gift will not be abused and will also be returned (Zucker, 1986; Shapiro, 1987). Knowledge that is classified and highly sensitive is exchanged between individuals from different firms, even if the giver and their firms may be at risk when the givee abuses the trust placed in him. Bouty (2000) shows that despite the risks, giving and favor exchange of this kind ends up helping both giver, givee, and both their firms. In such circumstances

the risks and costs of knowledge development and diffusion can be considerably reduced when gift exchange is used as a coordination mechanism. Knowledge is thus exchanged via informal routes and personal networks, possibly transcending organizational borders (Allen, 1977; Kreiner & Schultz, 1993; Von Hippel, 1987) as communities-of-practice may extend beyond them (Wenger & Snyder, 2000; Wenger, 1998; Brown & Duguid, 1991; 2001). Gift exchange both relies on and establishes a shared frame of reference that allow the parties involved to determine what the risks and costs are of using this mechanism as opposed to another mechanism (cf. Van Eijk et al. 2006). Gift exchange allows people to establish and maintain social relations that can help actors gain access to relevant individuals and communities while allowing at the same time some 'guarantee' to prevent abuse.

2.4 Conclusion

In addition to market and hierarchy there is a third coordination mechanism, one that is not much discussed: gift exchange in social relations. Some have argued that gift exchange is conceptually of the same order as market or hierarchy; we argue that it is of a different order, requiring additional concepts to understand (Biggart & Delbrigde, 2004). In this chapter we argue that in the context of knowledge development and diffusion gift exchange has often been the preferred alternative. We discuss this coordination mechanism conceptually, especially focusing on the context of knowledge development. Depending on the circumstances one mechanism may be better suited to provide coordination; in some circumstances coordination mechanisms work in tandem (Adler 2001; Bradach & Eccles 1989). Gift exchange offers an understanding of how social relations develop and are maintained that allows for the trust required under the circumstances of uncertainty that characterize knowledge development.

Gift exchange allows actors to forge and personalize relationships and to develop guarantees through personal bonding (Zucker 1986; Shapiro 1987). As anthropologists in line with Mauss have argued: there is a need to give, receive, and reciprocate. If one does not adhere to this, one may be ex-communicated and barred from exchanges that are both socially and economically meaningful. This certainly holds for non-standard situations where technological and market uncertainty and the possibility of opportunism are high such as for venture capital provision in Silicon Valley (Ferrary 2003), as well as in markets that are mature (Darr 2003). Contrary to the dictum of the New Institutional (Neoclassical) Economics that 'in the beginning there were markets', Boulding (1981) has even claimed that gift exchange is the quintessential kind of exchange. In the context of knowledge development he certainly is correct.

References

Aalbers, R., W. Dolfsma & O. Koppius (2006), 'Not Just with your Friends: Knowledge Transfer in Organizations', Working paper, Erasmus University Rotterdam.

Abreu, D. (1988), 'On the Theory of Infinitely Repeated Games with Discounting', *Econometrica,* 56(2), 383-96

Adams, J.S. (1965), 'Inequity in social exchange', *In: Advances in experimental social psychology*., Ed. Berkowitz, L., New York: Academic Press

Adler, P.S. (2001), 'Market, Hierarchy, and Trust : The Knowledge Economy, and the Future of Capitalism', *Organization Science* ,12(2), 215-34

Adler, P.S. & S.W. Kwon (2002), 'Social capital : prospects for a new concept', *Academy of Management Review*, 27(1), 17-40

Agrawal, A.K., Cockburn, I.M., & J. McHale, (2003), 'Gone but not forgotten : Labor flows, knowledge spillovers and enduring social capital', *Working Paper 9950*

Akerlof, G.A. (1982), 'Labor Contracts as Partial Gift Exchange' *Quarterly Journal of Economics*, 97, 543-569

Allaire, Y. & M.E. Firsiroty (1984), 'Theories of Organizational Culture', *Organization Studies*, 5 (3), 193-226

Allen, T.J. (1977), *Managing the flow of technology: Technology Transfer and the dissemination of technological information within the R&D organization,* Cambridge MA: The MIT Press

Allen, T.J., & S.I. Cohen (1969), ' Information flow in research and development laboratories', *Administrative Science Quarterly,* 14*,* 12-19

Arrow, K. (1974), *The Limits of Organization*, New York: Norton

Arrow, K.J. (1972), 'Gifts and Exchanges', *Philosophy and Public Affairs*, 1, 343-362

Arrow, K.J. (1984), 'Information and economic behavior', *In: Collected Papers of Kenneth J. Arrow (Vol.4)*

Avner, O. (1997), 'Between the Gift and the Market: The Economy of Regard', *The Economic History Review,* 50(3), 450-476

Axelrod, R. (1984), *The Evolution of Cooperation*, New York: Basic Books

Barnard, C.I. (1968), *The functions of the executive, 30th anniversary ed.*, Cambridge: Harvard

Barber, B. (1977), 'Absolutization of the market', *In: Markets and morals*, Ed. G. Bermant, Washington, DC: Heminsphere.

Belk, R. (1979), 'Gift-Giving behavior', *In: Research in Marketing Volume 2*, Ed. Sheth, J., Greenwich, CT:, JAI Press

Biggart, N.W., & R. Delbridge, (2004), 'Systems of exchange', *Academy of Management Review,* 29(1), 28-49

Blau, P. (1964), *Exchange and Power in Social Life*, New York: Wiley

Boulding, K.E. (1981), *A Preface to Grants Economics – The Economics of Love and Fear,* New York: Praeger.

Bourdieu, P. (1977), Outline of a Theory in Practice, Cambridge University Press: Cambridge

Bourdieu, P. (1986), 'Forms of Capital', *In:Handbook of Theory and Research for the Sociology of Education.,* Ed. Richardson, J.G., New York: Greenwood Press.

Bourdieu, P. & R. Nice (1980), 'The production of belief: contribution to an economy of symbolic goods', *Media, Culture & Society,* 2, 261-293

Bouty, I. (2000), 'Interpersonal and Interaction Influences on Informal Resource Exchanges between R&D Researchers across Organizational Boundaries, *Academy of Management Journal*, 43(1), 50-65

Bowles, S., & H. Gintis (1998), 'The Moral Economy of Communities: Structured Populations and the Evolution of Pro-Social Norms', *Evolution and Human Behavior,* 19, 3-25

Bradach, J.L., & R.G. Eccles (1989), 'Price, Authority, and Trust: From Ideal Types to Plural Forms' *Annual Review of Sociology*, 15, 97-118

Brown, J.S. & P. Duguid (1991), 'Organizational Learning and Communities of Practice: Towards a Unified View of Working Learning and Organizing', *Organization Science,* 2(1), 40-57

Brown, J.S. & P. Duguid (2001), 'Knowledge and Organization: A Social Practice Perspective', *Organization Science,* 12(2), 198-213

Bugental, D. B. (2000), 'Acquisition of the Algorithms of Social Life: A Domain-Based Approach', *Psychological Bulletin*, 126(2), 187-219

Burt, R. S. (2004), 'Structural Holes and Good Ideas', *American Journal of Sociology,* 110, 442-455
Carrier, J. (1991), 'Gifts, Commodities, and Social Relations: A Maussian View of Exchange', *Sociological Forum*, 6(1), 119-136
Cheal, D. (1986), 'The Social Dimensions of Gift Behaviour', *Journal of Social and Personal Relationships*, 3, 423-39.
Cicourel, A. (1973), *Cognitive sociology: Language and meaning in social interaction*, Harmondsworth, England: Penguin Books
Coase, R.H. (1937), 'The nature of the firm', *Economica*, 4, 386-405
Cohendet, P., Creplet, F., Diani, M.,Dupouet, O., & E. Schenk (2004), 'Matching Communities and Hierarchies within the Firm', *Journal of Management and Governance,* 8*,* 27-48
Coleman, J.S. (1988), 'Social Capital: in the creation of Human Capital', *American Journal of Sociology*, 94 Supplement, S95-S120
Coleman, J.S. (1990), *'Foundations of Social Theory'*, Cambridge MA: Belknap Press.
R. Cowan , P.A. David & D. Foray (2000), 'The Explicit Economics of Knowledge Codification and Tacitness', *Industrial and Corporate Change*, 9(2): 211-253, 2000.
Cross, R., Borgatti, S., & A. Parker (2002), 'Making Invisible Work Visible: Using Social Network Analysis to support Human Networks', *California Management Review,* 44(2), 25-46
Darr, A. (2003), 'Gifting Practices and Inter-organizational Relations: Constructing Obligations Networks in the Electronics Sector', *Sociological Forum*, 18(1), 31-51
Davenport, T.H. (1997), 'Ten principles of knowledge management and four case studies', *Knowledge and Process Management,* 4(3), 187-208
Deckop, J.R., Cirka, C.C., & L.M. Andersson (2003), 'Doing Unto Others: The Reciprocity of Helping Behavior in Organizations', *Journal of Business Ethics*, 47, 101-113
Dolfsma, W. (1998), 'Labor Relations in Changing Capitalist Economies – The Meaning of Gifts in Social Relations', *Journal of Economic Issues* 32(2): 631-8.
Dolfsma, W. (2006), 'IPR's, Technical Development, and Economic Development', *Journal of Economic Issues* 40(2), 333-342.
Dolfsma, W. (2008), *Knowledge Economies – Innovation, Organization and Location*, London: Routledge
Van der Eijk, R., W. Dolfsma & A. Jolink (2006), 'No Black Box *and* No Black Hole: from Social Capital to Gift Exchange', working paper Erasmus University Rotterdam.
Ferrary, M. (2003), 'The Gift Exchange in the Social Networks of Silicon Valley', *California Management Review,* 45(4), 120-138
Fiske, A.P. (1992), 'The Four Elementary Forms of Sociality: Framework for a Unified Theory of Social Relations', *Psychological Review*, 99(4), 689-723
Foa, E. & U.G. Foa (1980), 'Resource theory: Interpersonal behavior as exchange', *In:Social Exchange: Advances in theory and research,* Eds. Gergen, K., Greenberg, M., & Willis, R.*.,* New York: Plenum
Freeman, C. (1991), 'Networks of innovators: A synthesis of research issues', *Research Policy*, 20, 499-514
Galbraith, J.R. (1973), *Designing Complex Organizations*, Addison-Wesley, Reading, MA.
Gouldner, A.W. (1960), 'The Norm of Reciprocity: A preliminary statement', *American Sociological Review*, 25, 161-178
Granovetter, M.S. (1985), ' Economic action and social structure: The problem of embeddedness', *American Journal of Sociology,* 91, 481-510
Grant, R.M. (1996), 'Towards a Knowledge-Based Theory of the Firm', *Strategic Management Journal*, 17, 109-22.
Hansen, M.T. (1999), 'The Search-Transfer Problem: The Role of Weak Ties in Sharing Knowledge', *Administrative Science Quarterly,* 44(1), 82-111
Hayek, F. (1945), ' The use of knowledge in society', *American Economic Review*, 35, 519-530

Heath, A.F. (1976), *Rational Choice and Social Exchange: A critique of Exchange Theory*, Cambridge University

Press
Heide, J.B. & A.S. Miner (1992), 'The shadow of the future: Effects of anticipated interaction and frequency of contact on buyer-seller cooperation', *Academy of Management Review*, 35, 265-291
Hennart, J. (1993), 'Explaining the Swollen Middle: Why Most Transactions Are a Mix of "Market" and "Hierarchy"', *Organization Science,* 4(4), 529-547
Hill, C.W.L. (1990), Cooperation, opportunism and the invisible hand: Implications for transaction cost theory', *Academy of Management Review*, 15(3), 500-513
Hofstede, G. (1991), *Cultures and Organizations: software of the mind,* London: HarperCollins Business
Homans, G.C. (1950), *The Human Group*, New York: Harcourt, Brace
Homans, G.C. (1958), 'Social Behavior as Exchange', *American Journal of Sociology*, 63, 597-606
Homans, G.C. (1974), *Social Behavior: Its elementary Forms*, New York: Harcourt Brace Jovanoviech
Humphrey, C & S. Hugh-Jones (1992), *Barter, Exchange and Value*, Cambridge, UK Cambridge University Press
Huysman, M. & D. de Wit (2004), 'Practices of Managing Knowledge Sharing: Towards a Second Wave of Knowledge Management', *Knowledge and Process Management*, 11(2), 81-92
Iannello, K.P. (1992), *Decisions without Hierarchy,* Routledge, New York
Ingram, P. & P. Roberts (2000), 'Friendship among Competitors in the Sydney Hotel Industry', *American Journal of Sociology*, 106(2), 387-423
Jacques, E. (1990), 'In praise of hierarchy', *Harvard Business Review*, 68, 127-133
Katz, L.M & H.S. Rosen (1994), *Microeconomics,* Irwin ; Boston, MA
R. Klein Woolthuis, B. Hillebrand & B. Nooteboom (2005), 'Trust, contract and relationship development', *Organization Studies*, 26(6), 813-840.
Kogut, B., & U. Zander (1992), 'Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology', *Management of Technology,* 3(2), 383-397
Komter, A.E. (1996), *The Gift : An Interdisciplinary Approach*, Amsterdam: Amsterdam University Press
Kreiner, K., & M. Schultz (1993), 'Informal Collaboration in R&D. The formation of Networks across Organizations', *Organization Studies,* 14(2)*,* 189-209
Kreps, D.M. (1990), 'Corporate culture and economic theory', *In: Perspectives on Political Economy*, Eds. Alt J. & Shepsel, K., Cambridge UP.
Larsen, D. & J.J. Watson (2001), 'A Guide Map to the Terrain of Gift Value', *Psychology & Marketing*, 18(8), 889-906
Lawler, E., Thye, S., & J. Yoon (2000), 'Emotion and group cohesion in productive exchange', *American Journal of Sociology*, 106, 616-657
Le Grand, J. *(2003), Motivation, Agency, and Public Policy: Of Knights and Knaves, Pawns and Queens,* Oxford University Press
Levinthal, D.A. & J.C. March (1993), 'The myopia of learning', *Strategic Management Journal*, Winter special issue, 14, 95-112
Levi-Strauss, C (1996), 'The principle of reciprocity', *In:The Gift: An Interdisciplinary Perspective,* Ed. Komter, A.E., Amsterdam: Amsterdam UP.
Lopes, H. & J.C. Caldas (2008), 'Firms: collective action and its supportive values', *In: Companion to Social Economics*., Eds. Davis, J. & Dolfsma, W., Cheltenham: Edward Elgar.
Madhaven, R., & Grover, R. (1998), 'From embedded knowledge to embodied Knowledge: New product development as knowledge management', *Journal of Marketing*, 62, 1-12
Maitland, I. (2002), ' The Human Face of Self-Interest', *Journal of Business Ethics*, 38, 3-17
Malinowski, B. (1996), 'The Principle of Give and Take', *In The Gift: An Interdisciplinary Perspective*, Ed. Komter, A.E., Amsterdam: Amsterdam University Press
Mauss, M. (1954) [2000], *The Gift: Forms and Functions of Exchange in Archaic Societies.,* New York: Norton
Merton, R.K. (1968), 'The Matthew Effect in Science: the reward and communication systems of science are considered', Science, 159, 56 - 63
Miles, R., & C. Snow (1986), 'Organizations new concepts for new forms', *California Management Review*, 28,

62-73
Mintzberg, H. (1979), *The structuring of organizations*, Prentice-Hall, Englewood Cliffs; NJ
Molm, L.D. (2003), 'Theoretical Comparisons of Forms of Exchange', *Sociological Theory*, 21(1), 1-17
Moran, P., & S. Ghosal (1996), 'Value creation by firms', *Academy of Management Proceedings*, 35-39
Nahapiet, J., & S. Ghosal (1998), 'Social capital, intellectual capital, and the organizational advantage', *Academy of Management Review,* 23(20*),* 242-266
Nelson, R.R. (1959), 'The simple economics of basic scientific research', *Journal of Political Economy*, 57, 297-306
Nelson, R.R. (2004), 'The market economy, and the scientific commons', *Research Policy*, 33(3), 455-471
Nooteboom, B. (2002), *Trust: Forms, Foundations, Functions, Failures and Figures*, Edward Elgar, Cheltenham
Nooteboom, B. (2000), *Learning and innovation in organizations and economies*, Oxford: Oxford University Press.
Nye, F, I. (1979), 'Choice, Exchange and The Family', *In: Contemporary Theories about the Family, Eds.* Burr, W.R. et al., New York: Free Press
Organization for Economic Co-operation and Development (2001), *Science, Technology and Industry Outlook 2001*., Paris: OECD.
Ostrom, E. & T.K. Ahn (2003), *Foundations of Social Capital,* Northhampton: Edward Elgar Publishing Limited.
Ouchi, W.G. (1980), 'Markets, bureaucracies, and clans', *Administrative Science Quarterly,* 25(1), 129-141
----, (1979), 'A Conceptual Framework for the Design of Organizational Control', *Management Science,* 25(9), 833-848
Parkhe, A. (1993), 'Strategic alliance structuring: A game theoretic and transaction cost examination of inter-firm cooperation', *Academy of Management Journal*, 36, 794-829
Parsons, T. (1951), *The Social System*, London: Routledge and Kegan Paul.
Peters, T. (1987), *Thriving on Chaos*, Pan Books, London
Portes, A. & J. Sensenbrenner (1993), 'Embeddedness and immigration: notes on the social determinants of economic action', *American Journal of Sociology*, 98, 1320-1350.
Powell, W. (1990), 'Neither market nor hierarchy: Network forms of organization', *Research in Organization Behavior,* 12, 295-336
Powell, W.W., Koput, K.K., & L. Smith-Doerr (1996), 'Inter-organizational collaboration and the locus of innovation' Administrative Science Quarterly, 41, 116-145.
Putnam, R.D. (2000), *Bowling Alone: the Collapse and Revival of American Community*, New York: Simon & Schuster.
Rangan, S. (2000), 'The Problem of Search and Deliberation in Economic Action: When Social Networks Really Matter', *The Academy of Management Review*, 25(4), 813-828
Reagans, R. & B. McEvily (2003), 'Network Structure and Knowledge Transfer: the Effects of Cohesion and Range', *Organization Science,* 13(3), 232-48
Ring, P.S. & A. van de Ven (1992), 'Structuring cooperative relationships between organizations', *Strategic Management Journal*, 13, 483-498.
Romer, P. (2002), 'When should we use intellectual property rights', *American Economic Review* 92(2), 213-16
Romme, A.G. L. (1996), 'A Note on the Hierarchy-Team Debate', *Strategic Management Journal,* 17(5), 411-17
Rose-Ackerman, S. (1998), 'Bribes and Gifts', *In:* A. Ben-ner &
Putterman, L. (Eds.), *Economics, values and organization,* Cambridge UP.
Rousseau, D.M. (1990), 'Assessing Organizational Culture: The Case for Multiple Methods', *In:Organizational Climate and Culture*, Ed. Schneider, B. , San Francisco: Jossey-Bass
Sahlins, M. D. (1996), 'On the Sociology of Primitive Exchange', In: A.E. Komter (Ed.) *The Gift: An Interdisciplinary Perspective*, Amsterdam: Amsterdam UP.
Schein E.H. (1992), *Organizational Culture and Leadership, 2nd edition*
Schein, E.H. (1965), *Organization Psychology*, New York: Prentice-Hall, Englewood Cliffs.
Schumpeter, J. (1934 [1978]), *The Theory of Economic Development*, London; Oxford University Press

Schwartz, B. (1996), 'The Social Psychology of the Gift', *In: The Gift: An Interdisciplinary Perspective,* Ed. Komter, A.E., Amsterdam: Amsterdam UP.
Scott, W.R. (1992), *Organizations: Rational, Natural and Open Systems*, Harper; New York
Seidl, J., & W. McMordie (1978), *English idioms and how to use them*, Oxford: Oxford University Press
Senge, P.M. (1990), *The Fifth Discipline*, Doubleday Currency, New York
Shapiro, S.P. (1987), 'The social control of impersonal trust', *American Journal of Sociology*, 93, 623-658
Sherry, J.F. (1983), 'Gift Giving in Anthropological Perspective', *The Journal of Consumer Research,* 10(2), 157-68
Simmel, G. (1996), 'Faithfulness and Gratitude', *In:The Gift: An Interdisciplinary Perspective*, Ed. Komter, A.E., Amsterdam: Amsterdam University Press
Smart, A. (1993), 'Gifts, Bribes, and Guanxi: A reconsideration of Bourdieu's Social Capital', *Cultural Anthropology,* 8(3), 388-408.
Soete, L. & B. ter Weel (2005), *The Economics of the Digital Society*, Cheltenham: Edward Elgar.
Steidlmeier, P. (1999), 'Gift Giving, Bribery and Corruption: Ethical Management of Business Relationships in China', *Journal of Business Ethics,* 20, 121-132
Stigler, G. (1968), 'Competition', *In: International encyclopedia of the social sciences*, vol. 3, Ed. Sills, D.L., New York: Macmillan.
Stiglitz, J.E. (1994), *Wither Socialism?,* MIT Press, Cambridge, MA
Telser, L.G. (1980), 'A theory of self-enforcing agreements', *Journal of Business,* 53, 27-44
The Economist (2006), *The business of giving – a survey of wealth and philanthropy*, February 25.
Thorelli, H.B. (1986), 'Networks: Between Markets and Hierarchies', *Strategic Management Journal*, 7(1), 37-51
Tsai, W. & S. Ghosal (1998), 'Social Capital and Value Creation: The role of intra firm networks', *Academy of Management Journal,* 41(4), 464-476
Vandevelde, A. (2000), 'Reciprocity and trust as social capital' (in Dutch), *In: Over Vertrouwen en Bedrijf*, Ed. Vandevelde, A., Leuven: Acco,
Von Hippel, E. (1987), 'Corporation between rivals: Informal know-how trading', *Research Policy,* 16, 291-302
Walster, E., Berscheid, E., & G.W. Walster (1973), 'New Directions in Equity Research', *Journal of Personality and Social Psychology*, 25(2), 151-176
Weber, M. (1978), *Economy and Society,* Berkeley: University of California Press
Weigelt, K. & C. Camerer (1988), 'Reputation and corporate strategy: A review of recent theory and applications', *Strategic Management Journal,* 9, 443-454
Wenger, E.C. (1998), *Communities of Practice: Learning, meaning and identity*, Cambridge: Cambridge UP.
Wenger, E.C., & Snyder, W. (2000), 'Communities of Practice the Organizational Frontier', *Harvard Business Review*, 139-145
Williams, B. (1988), 'Formal structures and social reality', *In: Trust: Making and Breaking of Cooperative Relations*, Ed. Gambette, D., Oxford: Blackwell
Williamson, O.E. (1985), *The Economic Institutions of Capitalism: Firm Markets, Relational Contracting*, New York: Free Press
----, (1975), *Markets and Hierarchies: Analysis and Antitrust Implications*, New York: Free Press
Zeitlyn, D. (2003), 'Gift economies in the development of open source software' ,*Research Policy,* 32(7), 1287-91.
Zucker, L.G. (1986), 'Production of trust: Institutional sources of economic structure, 1840-1920.', *Research in organizational Behavior,* 8, 53-111

Chapter 3
No Black Box and No Black Hole: from Social Capital to Gift Exchange [22]

3.1 Introduction

Social capital resides in members of a group, and in their relations. Social capital may extend to (parts of) a company, and may extend beyond the company. Understanding social capital is relevant for understanding what is going on within and between companies. How does social capital emerge, how is it maintained, and how is it used? The vast literature on social capital has only begun to address these questions.

Over the years, the concept of social capital has gathered attention at an extraordinary rate. Fine (2000) states that social theory is currently being rewritten through the lens of social capital. The idea that relationships and social networks are a valuable asset, in that they can facilitate action, is the common denominator. As such, much of the attention of scholars has focused on the tangible benefits social capital can provide, and has, as such, been put to the test in a wide variety of contexts (e.g. Adler & Kwon, 2002; Field, 2003; Fine, 2000; Portes & Sensenbrenner, 1993; Woolcock, 1998) demonstrating its relevancy in those contexts. Despite its popularity, social capital has not yet crystallized and conceptually is still hampered by the lack of a common definition regarding the concept and its elements (Adam & Roncevic, 2003). Furthermore, much attention in the literature has been directed to identifying social capital and less so to issues of how social capital is created, how it is put to use and how it is maintained. These processes are not self-evident: the benefits of social capital do not materialize at will and not every individual is likely to benefit to the same extent.

The focus of this paper is on relations between individuals in a community and the cooperation between them. These relations will be studied by reviewing the economic and management literature on social capital, supplemented by the literature in sociology and anthropology on gift exchange. This latter literature focuses, on the one hand, on gift exchange as a possibly instrumental exchange of resources, services or information. On the other hand, in line with Homans (1950), the literature reveals that relatively frequent gift exchange generates cohesion and commitment to exchange relations (Lawler et al., 2000) where people are more likely to invest in mutual relationships under such circumstances (Mauss, 1954; Bourdieu, 1977; Larsen and Watson, 2001). From this literature, social capital emerges as a consequence of exchange relations, capturing the procedural aspects of social relationships. The literature on gifts suggests mechanisms for reciprocity, equity, interpretation/meaning and the strength of a relationship, which may be tied up with the existing literature on social capital.

22 This chapter is a revised version of van der Eijk, R., Dolfsma, W & Jolink, A (200), On a source of social capital: gift exchange, Journal of Business Ethics, in press.

In this conceptual paper we argue that socials capital, as a concept, remains a black box in the sense that the mechanisms that constitute it remain underdeveloped and that it is a black hole in the sense that many empirical phenomena are attributed to its presence. The literature on gift exchange suggests ways of opening the black box by exploring mechanisms, proposing that creation, use and maintenance of social capital is to be understood as a corollary of gift exchange.

3.2 Social Capital

The concept of social capital was mainly developed in the late 1980s. Although the first use of the term social capital has been credited to Hanifan in 1916 (Dika & Singh, 2003; Fine, 2000), Bourdieu (1986), Coleman (1988) and Putnam (1993) are considered to be the founding fathers of the concept of social capital. Their approach and conceptualization of social capital differ substantially mainly resulting from the respective points of departure or perspectives. One of the contentious points for discussion is whether social capital is an egocentric or a sociocentric concept – i.e. does it reside in individuals or in the relations between them (Adam & Roncevic, 2003; Adler & Kwon, 2002)? Most authors, however, agree with Coleman that social capital deals with aspects of social structure which enable social action; social relationships can act as a resource for social action (Coleman, 1988; Burt, 1992; Bourdieu, 1986). Tentatively, one may describe social capital as the sum of actual or potential resources embedded within, available through, and derived from the social structure that facilitate exchange and social interaction. As a function of the configuration and content of the network of more or less durable social relations, one can access social capital either directly or indirectly. Social capital thus emerges as the intended, instrumental or unintentional result of social interaction or exchange.

Adler & Kwon (2002) have argued that social capital has a number of characteristics. First, social capital can be invested in, for instance one can expand or deepen one's network of external contacts thus enlarging the stock of social capital (Bourdieu, 1977, 1986). Second, social capital is appropriable in the sense that an actor's network can be used for different purposes by the focal actor and not by others (Coleman, 1988; Bourdieu, 1986). Third, social capital needs maintenance as social ties may weaken due to relational atrophy (Cheal, 1988). Four, social capital resides in individuals as well as in mutual ties. As a result, if one party defects on or terminates the relationship, social capital vanishes. Social capital in some ways resembles a "collective good" (e.g. Coleman, 1988). Although one can 'own' social capital, it is not one's private property since it resides in the ties between individuals. However, unlike a pure "collective good", one can exclude others or be excluded by others from social capital's benefits.

Nahapiet and Ghosal (1998) claim that social capital can be argued to have three dimensions: a structural, a relational and a cognitive dimension. The structural dimension describes the totality of impersonal configuration of linkages between actors (Nahapiet & Ghosal, 1998; Scott, 1991; Wasserman & Faust, 1994). According to Coleman (1988), social capital is accumulated history in the form of a social structure appropriable for productive

use by an actor in the pursuit of his interests. Among the most important facets of the structural dimension we can identify the presence or absence of network ties between actors (Scott, 1991; Wasserman & Faust, 1994). The significance of an actor's social capital is not exclusively determined by the number of direct and indirect ties and the respective resources that the individuals have at their disposal. The structural embeddedness or configurations of ties that make up an individual's exchange network play a role as well. Thus the configurations of the focal actor's exchange network affect the quality of someone's exchange network and therefore his social capital. Networks – defined as specific types of relations linking sets of people, objects or events (Knoke & Kuklinski, 1982) – may however be just one example of the structural dimension of social capital.

Secondly, the relational dimension focuses on the specific content of an individual's ties: how individuals value their contacts, over and above the quantity of ties. The emphasis is on the behavioral embeddedness of social relations, which "describes the kind of personal relationships people have developed with each other through a history of interactions" (Granovetter, 1992).

Thirdly, the cognitive dimension of social capital deals with that aspect of the social infrastructure which represents shared meanings and interpretations. As Foley and Edwards (1997) have argued: "social capital cannot be conceived in purely structural terms because even in its structural sense it carries a cultural freight ('expectations, obligations, trust') that is nested in structure but not simply reducible to structure. Second, what is equally clear about the cultural component of social capital is that it is appropriated by individuals but is not simply an attribute of individuals (...) It is precisely this socio cultural component of social capital that provides the context with which it acquires meaning and becomes available to individuals and groups in a way that can facilitate an individual or collective action not otherwise possible". The cultural dimension then represents a resource in that it provides shared understanding among parties (Nahapiet & Ghosal, 1998; Cicourel, 1973). If one were to take a sociocentric position, one would obviously be more inclined to emphasize this cognitive dimension.

Coleman (1988) emphasizes that social capital constitutes an aspect of the social structure and is capable of facilitating the actions of individuals within that structure. These actions relate to the (potential) benefits of social capital, identified and categorized by Sandefur and Laumann (1998): information, influence and solidarity. These benefits allow actors to achieve ends which would be impossible to achieve without social capital, or only by means of (significant) additional costs.

A substantial amount of research, in difference areas, has focused on the (mostly positive) consequences of social capital (e.g. Alder & Kwon, 2002; Jackman & Miller, 1998; Field, 2003; Fine, 2000; Portes & Sensenbrenner, 1993; Woolcock, 1998). Significantly less has been written about the way social capital is created and maintained, which is at stake in this paper. Or, as Ulmann Margalit (1978) argues: an explanation is incomplete if the How-question is not addressed in addition to the Why-question.

3.3 Social Capital & Gift Exchange

The literature on social capital, trust, and collaboration identifies a number of sources of cooperation, most of which can be categorized in two categories (e.g. Shapiro, 1987; Nooteboom, 2002). On the one hand, impersonal sources, such as sanctions by an external authority, social norms and values, are discussed (Bradach & Eccles, 1989; Dore, 1983; Granovetter, 1985; Zucker, 1986). Personal sources as a source of social capital and trust are, on the other hand, discussed in this literature as well. In part motivated by self interest, current and ongoing cooperation can bring benefit to the focal actor (Abreu, 1998, Axelrod, 1984, Frank, 1988, Heide & Miner, 1992, Hill, 1990, Kreps et al., 1982, Parkhe, 1993; Telser, 1980). A focal actor's reputation (Weigelt & Caramer, 1988; Kreps, 1990; Coleman, 1988), or the hostages taken by the focal actor (Williamson, 1985), can be a basis for the focal actor to trust the partner to cooperate. Some others refer to such sources of social capital as closed networks, shared ideology, culture, and social norms and values without further elaboration (Coleman 1988, Ferrary 2003, Field 2003, Laumann and Pappi 1982, Portes 1998, Putnam 1993, Sandefur & Laumann 1988). In part the latter are motivated by altruistic motivations such as relations of affect as well as by routines or individual habits. Where impersonal sources of cooperation from the point of view of an individual actor can be regarded as a given and can only to be altered indirectly, personal sources, arising in specific personalized interactions, can be influenced. In this paper we suggest that gift exchange provides the actor with the means to create and maintain relations of trust where social capital might be said to reside. In the literature the purported effects of a presence of social capital is mostly discussed. Social capital appears to emerge from a black box, and is enigmatically invoked to explain a plethora of phenomena –mostly good but sometimes bad. In that respect social capital is in many cases perceived as a black hole. By suggesting a way in which the creation, maintenance, but also demise of trust and social capital can be understood, we may be able to open the black box.

Some authors have hinted at other sources for social capital, leaving most of the elaborations for later. Putnam (1993) points at norms, trust and network ties as sources of the creation and maintenance of social capital. For Coleman (1988) social capital results from properties of social structures, most notably network closure and multiplex ties, but this seems to raise an even larger amount of questions. According to Portes (1998) the motives of recipients and donors are sources of social capital. She distinguishes between consummatory motives, referring to an internalized norm resulting from socialization during childhood and/or from a shared faith, and instrumental motives, referring to access to resources. The viability of instrumental motives in the creation of social capital results from the creation of mutual obligations and enforceable trust. Bourdieu (1986) emphasizes the instrumental nature of social capital construction as well.

Bourdieu (1986) and Coleman (1988) argue that social capital can be formed purposefully as well as unintentionally. Social capital may result from instrumental behavior. Bourdieu emphasizes the role of social obligation, trust and the advantages of connections in social capital (Smart, 1993). Bourdieu underlines the fact that connections and obligations

are not givens, but are the product of investment strategies - consciously or unconsciously - aimed at establishing or reproducing social relationships that are directly usable in the short or long term (Bourdieu, 1977; 1986). Thus, self-interested and otherwise purposive actors may strategically enter into certain kinds of relationships (Coleman, 1990, 1994; Field, 2003; Portes, 1998; Sandefur & Laumann, 1998). Social capital may also be a byproduct of broad spectrum of activities, and many investments in social capital are not intentionally made as such. Social capital may emerge and vanish as a byproduct of activities engaged in for reasons other than the accumulation of social capital (Coleman, 1988, 1990; Field, 2003; Sandefur & Laumann, 1998; Paldam & Svendsen, 2000). In addition, its value is often as much for the broader public as for those individuals who actually belong to and have invested in the relations (Coleman, 1988; Field, 2003).

In this paper we will draw on the concept of gift exchange, developed predominantly in the anthropological literature, as a concept which allows social scientists to understand how relations emerge, how they are maintained, and how they may be drawn on. As Portes (1998) has pointed out: "Resources obtained through social capital have, from the point of view of the recipient, the character of a gift". The notion of gift in this literature is thus more encompassing than the one understood in ordinary day life. Here gifts are equated with *charitable* gifts – a significant economic phenomenon (Economist, 2006). Coleman (1994) cites examples of individuals' intentional creation of obligations by, for instance, performing unsolicited favors and giving gifts to others. These obligations become a basis for future exchange. Coleman in particular argues that they are a kind of 'entitlement' to future social support.

Gift exchange and emergence of social capital

Boulding (1981) surmises that gift exchange is the quintessential form of exchange. The vast literature on gift exchange points out that gift exchange plays a vital role in the construction of social networks (Cheal, 1996; Larsen & Watson, 2001; Gouldner, 1960); gifts may be used to initiate, maintain, or sever relationships with individuals or groups (Belk, 1979; Sherry, 1983; Larsen & Watson, 2001; Cheal, 1996; Darr, 2003; Mauss, 1954; Gouldner, 1960). Frequent gift or favor exchange leads to positive emotions and uncertainty reduction which, in turn, generates cohesion and commitment to exchange relations (Lawler et al., 2000).

In contrast to popular belief, gifts may be exchanged for both instrumental as well as for more purely altruistic reasons. Classical anthropologists such as Mauss and Malinowski have argued persuasively that, indeed, the exchange of gifts is motivated by self-interest in many cases. Even when altruistic motives play a role, these tend not to be unrelated to the motive of self interest. By drawing on the well-established research on gifts, one is able to incorporate all of the dimensions that are attributed to social capital, as well as clarify how social capital is established and maintained.

The literature on gift exchange points out that gift exchange may both be a form of ***instrumental*** behavior often taking place in a context of quasi enforced reciprocity, but the obligations resulting from gift exchange may also be an ***unintentional by-product*** (Blau, 1964, Bourdieu, 1977, Heath, 1976; Homans, 1974; Mauss, 1954). Rose-Ackerman (1998) points out that gifts, presented to people and institutions in a position where they might benefit the giver, actually come close to being prices (or, depending on the situation, even bribes) – if the appropriate ritual is not adopted(Smart 1993).

Gift giving may be a strategic, self motivated action meant to create an obligation in the exchange partner to reciprocate (Bourdieu, 1977; Humphrey & Hugh-Jones, 1992; Darr, 2003). The generosity and voluntarism observed in gift giving may be an illusion and only be altruism in appearance (Blau, 1964; Mauss, 1954). Ostensibly, there is not necessarily an expectation of equivalent or formal return ([Beals, 1970] quoted in Sherry, 1983), but in reality the purposive focal actor – consciously or unconsciously (Komter, 1996; McGrath et al., 1996; Levi-Strauss, 1996) – takes into account past and or future outcomes for herself, and is at least partly motivated by the expectation of some return-gift, whether direct (such as power over others) or indirect (such as social approval) (Blau, 1964). As Zucker (1986) argues, creation of trust is *implicit* in the expectation of a counter-gift in gift exchange; it should not become explicit, however (Bourdieu 1992, Darr 2003). It is, nevertheless, this equity over the longer term that makes the exchange mutually beneficial and therefore its existence and continuance is reasonable (Cook & Emerson, 1984). Enforcement is self-regulating, since, between equals, if one partner fails to reciprocate, the other actor is likely to discontinue the exchange (Nye, 1979).

Because gift exchange is generally unbalanced when viewed at one particular point in time, a longitudinal perspective more accurately reveals the nature of gift giving. A deferred return obligates one individual to another, and creates 'social debt'. Significant time may pass between the gift and the counter-gift. Gift exchange is carried out without a legal contract (Ferrary, 2003), but instead informal existence of interpersonal relationships and trust makes it possible to leave the particulars of the exchange unspecified (Uehara, 1990; Zucker, 1986). If the obligations could in fact be enforced and imposed on by third parties we would be talking about market transactions.

Gift exchange is a distinct form of exchange that is characterized by a set of **three principles** that Marcel Mauss (1954) has been very adamant about. As part of a community, anybody is obliged to (1) give, to (2) receive[23] and to (3) reciprocate (cf. Dore 1983; Gouldner, 1960; Levi-Strauss, 1996; Malinowski, 1996; Sahlins, 1972; Schwartz, 1996; Simmel, 1996). The imperative nature of this three-fold obligation derives from its cultural embeddedness (Sherry, 1983). These obligations are certainly social in that they are enforced by the community. In addition, they may have moral overtones. As a result, donors and recipients feel psychologically obliged to act according to the principles (cf. Schein, 1965). In a situation where this psychological contract is violated, one will question the reciprocal goodwill of the other. Acceptance of the gift is, to a certain extent, acceptance

23 Cf. proverbs "never look a gift horse in the mouth", "never criticize or express displeasure at a gift".

of the giver and the relationship between the parties (Larsen & Watson, 2001; Carrier, 1991). It is also an acceptance of the perception that the giver has of the receiver. It is for this reason that a gift which is perceived as improper by the receiver may be rejected, may fail to initiate a relation, and may harm an existing relation. Refusal of the initial gift marks the refusal to initiate the dynamic of exchange, thus to refuse a gift is to refuse a relationship and one's role in that relation (Ferrary, 2003; Mauss, 1954). Reciprocity is open to discretion as to the value and form of the counter gift: the currency with which the obligation is repaid can be different from the form with which they were incurred. Schwartz (1996) states that it is even prohibited to make an equal-return 'payment' (homeomorphic reciprocity) in gift exchange, as that is tantamount to returning the offered gift to the donor and discontinuing the relationship. Gift exchange is diachronous since reciprocity is open to discretion with regard to time; a gift is not reciprocated by immediate compensation, but instead by a deferred form of compensation (Mauss, 1954; Bourdieu, 1977; Ferrary, 2003.; Deckop et al., 2003). The 'objective' value of the counter-gift may be ostensibly lower then the original gift if circumstances permit this. If the party who is originally at the receiving end is evidently not in a position to return gifts of approximately equal value he need not do so – he may not have enough resources, but there may be other reasons for the scales being 'objectively' out of balance, even permanently (Komter 1996). Material value of gifts exchanged can be compensated for by obvious inculcation of immaterial value –such as time, effort and creativity– in the counter-gift. The instrumental nature of gift exchange can also be apparent when a dependent party who is evidently less well endowed gives to a more central party, being better endowed, in the expectation to receive in return, but certainly not something of equal value. The instrumental reason for giving in the first place is to be able to establish a relation that will be beneficial in the long run, possibly by being able to tap into the other relations that the receiving party maintains (Ferrary 2003). Thus, the exact nature or moment of the counter-gift is necessarily not specified beforehand – gifts are 'silent' as it were (Bourdieu, 1977; Gouldner, 1960; Mauss, 1954; Deckop et al., 2003). Many scholars emphasize that the return-gift should ultimately be of roughly equivalent value, however this equivalence refers to equivalence as defined by the actors involved, including their inter-subjective understanding of the value of the gifts actually exchanged, given an understanding of people's positions and endowments. 'Objectively', even in the long run, the exchange might not be equal in value (Gouldner, 1960).

Maintenance of social capital

Virtually any **resource** – material or immaterial, tangible or intangible, of high or low value – can be transformed into a gift or favor (Blau, 1964, Heath, 1976; Homans, 1974; Sherry, 1983). Gifts may be flowers, a box of chocolates, an invitation, a handshake or joke, a suggestion or tip one knows to be relevant, for the received attention or heed, knowledge and ideas. A gift may even take the form of money, if and when given with the proper ritual

such as a gift-wrapping (Zelizer 1997; Khalil 2004). The more obviously valuable a first gift is, for instance, the more the giver is likely to signal to the receiver or givee that the gift is actually a bribe or price.

The alteration from a resource to a gift is realized by observing and keeping in mind the social relationships, the proper occasions and decorum, and using the signals and rituals that should accompany gift giving as established in a community (Deal and Kennedy 1982). Relations start with gift giving, as they convey the message that one intends to relate to the other; gift giving conveys that one has a specific perception of the other as someone who would appreciate the gift offered and is willing and able to offer a counter-gift the original giver would also appreciate. A first gift is in fact an offer to become a member of an existing, what we would call, *Social Capital Community,* or, alternatively, a request to be allowed to join the Social Capital Community of the receiving party. A Social Capital Community can be as small as a group of two persons. Given the possibility to offend the receiver by giving a gift, the original gift with which a relation starts is not likely to be idiosyncratic. The more a first gift signals a specific perception of the receiver and his context, the bigger the chances of offense are as the giver might have misperceived the situation. Gift exchange allows for a common bond to be established and maintained ('social capital'), and thus contributes to value creation by providing access to resources.

Gift exchange serves both **economic** and **social purposes** (Belk, 1979; Larsen & Watson, 2001; Cheal, 1996), and may be mutually supportive (Ferrary 2003; Smart 1993).[24] While gift exchange is (necessarily) between individuals, these individuals may be from the same organization (e.g., Flynn 2003), or from different organizations, where individuals represent organizations (Child & Faulkner 1998, Ferrary 2003). Gift exchange has been regarded by some as a purely economic exchange between two parties (Larsen and Watson, 2001). Gift exchange is not merely an economic transaction, however, it is also a good in itself, a 'process benefit', establishing or affirming, but possibly also damaging, destroying or forestalling a personal relationship (Ferrary 2003; Offer, 1997). Gifts not only transfer utility but are also social interactions embedded in social structures (Cheal, 1996). The relation between giver and receiver is primarily personal and can therefore have a value independent of and in addition to their instrumental function of regulating transactions (Rose-Ackerman, 1998). Darr (2003) thus claims that gift exchange and market transactions are 'inextricably intertwined' in contemporary markets (cf. Granovetter 1985, Dolfsma et al. 2005). Smart (1993, p.389) avows we should "avoid the Scylla of assuming that gift exchange and market exchange are completely different types of relationships and the Charybdis of dissolving the distinction in a unifying theoretical practice of explaining all actions as outcomes of the strategic pursuit of the advantage of the agent" (cf. Dore 1983). As there is a limit to the number of relations (ties) one is able to sustain – especially if the ties are strong ties – there is necessarily a boundary to one's (immediate) Social Capital Community. One may be able to tap into the social capital that inheres in more indirect connections, but only if one's

24 Some have argued that gift exchange may be the only type of exchange to create a commercial product that can be used – open source software being a case in point (Zeitlyn 2003).

direct relation allows this (Burt, 1992; Coleman, 1988; Granovetter, 1973, Lin, 1998). Gift exchange will generally not extent beyond an (emerging) Social Capital Community.
Social capital's ability to facilitate social action, in the absence of any legal enforcement, depends on individuals' willingness and sense of obligation towards the other. Many emphasize generalized reciprocity, such as in the example of voluntary blood donations to unknown others, usually related to concepts such as shared ideology, culture and norms/ values (Coleman, 1988; Ferrary, 2003; Field, 2000; Laumann & Pappi, 1982; Portes, 1998; Putnam, 1993; Sandefur & Laumann, 1988). Although generalized reciprocity can be defined as part of social capital, it does represent a less potent form of social capital and could be considered as an enabler. Social capital's ability to facilitate action is most effective if and when it results from gift exchange resulting personal obligations between concrete individuals. Individuals generally are more forthcoming towards friends and acquaintances than strangers or persons the are less connected with in general (Coleman 1988). Strong ties generally provide a larger likelihood of reciprocation than weak ties, where reciprocation facilitates actors' access to resources and support (Burt 1992, Hansen 1999). Once established, a Social Capital Community decreases the risk associated with exchange as a result of the reputation (Kreps, 1990; Ostrom and Ahn, 2003; Coleman, 1988; Sherry, 1983; Ferrary, 2003) and repeated interaction effect (Abreu, 1998, Fudenberg & Maskin, 1986; Kreps et al., 1982), hence actors' preference for dealing with insiders instead of outsiders. Thus in contrast to what many authors seem to assume social capital does not exist in absence of a social context; in its most potent form, social capital mainly results from concrete interaction (gift exchange) between concrete individuals.

Social capital thus needs **maintenance** (Adler and Kwon 2002). Gift exchange can be considered as an investment to create a relation that can be drawn on later and that can thus be referred to as social capital (Bourdieu, 1986; Nahapiet & Ghosal, 1998). "Gifts can be described as an investment in the relationship between donor and recipient. The greater the value of the gift, the more substantial the investment" (Larsen & Watson 2001, p.899). The generosity and voluntarism observed in gift giving may be an illusion and only an apparent altruism (Blau, 1964; Mauss, 1954). Indeed, social capital is not simply there for anybody to use, as both Coleman (1988) and Putnam (1993) assume. Investments are necessary since connections are not givens but require continuous maintenance (Bourdieu, 1977, 1986). Gift exchange engenders the relationships in which social capital can be said to reside (Bourdieu, 1986; Nahapiet & Ghosal, 1998). The symbolic denial of economic calculation of gift exchanges then serves the requirement of strategic interaction (Bourdieu, 1977).

Gifts - Inclusion & Exclusion

Social relationships and group boundaries are formed and sustained through the perpetuating exchange cycle of giving and receiving (Ruth et al., 1999). The latter aspect of the gift, its instrumentality in *maintaining* social ties (Belk, 1979; Cheal, 1988; Mauss, 1954; Ruth et al., 1999; Sherry, 1983; McGrath et al., 1996), is highlighted by Belk and Coon (1993) who stress that gift giving creates a bond of goodwill and social indebtedness between people.

In their argument, instrumental and altruistic motives are not so neatly separated. This indebtedness is what highlights gift giving as an exchange and perpetuates the exchange process – as long as the scales are not balanced. Gift exchange then establishes repetitive, self enforcing bonds (Offer, 1997); the outstanding obligations between the exchange partners make it expedient not to break off relationships, for both 'creditor' and 'debtor', as both have an interest in maintaining their long-term relation (Gouldner, 1960). On the other hand, however it has been argued that a person should not maintain a pattern of gift exchange that is perceived as highly unbalanced. This will not only affect his sense of emotional state of mind, but if it were to occur within a firm, for instance, this unbalance would make it less productive (Flynn 2003). Being perceived as a creditor, rather than as a debtor, however, does increase one's status or reputation within a community, something which may best be done by exchanging gifts frequently (Flynn 2003). An organization where gifts are exchanged is a caring organization where knowledge creation and diffusion is more likely to occur (Von Krogh 1998).

Belk and Coon (1993) emphasize how gift giving creates a bond of goodwill and social indebtedness between people. Indebtedness perpetuates the exchanges process. A deferred return obligates one individual to another, and therefore creates social debt. At the same time, Belk (1976) has described the tension generated and reduced in unbalanced exchanges as an important dynamic in gift giving. While the giving of large gifts that the receiver may not reciprocate enables one person to gain control over another person, exchanges of small or token gifts permit a recipient to demonstrate trustworthiness in the short run ([Blehr, 1974] taken from Sherry, 1983). Many gift exchanges that are meant to maintain social ties or bonds occur within a context of ritualized occasions, such as at birthdays or during Christmas. These ritualized occasions often serve as maintenance rites (Cheal, 1988), keeping the established relationships going (cf. Bourdieu 1977, 1986). A sequence of reciprocal gift exchanges establishes a transactional relationship between individuals (Sherry, 1983). Relations are, in other words, re-affirmed by regular gift exchange.

Social capital inheres in the ties between individuals and thus takes both parties to be drawn on. A counter-gift cannot be legally enforced and is by its very nature part of the social realm. Individuals can be (purposefully) **included** as well as **excluded** from a Social Capital Community. Understanding the emergence, maintenance and possible disappearance of social capital as arising from gift exchange, it becomes clear how and why boundaries are drawn between (groups of) social individuals, resulting in processes of inclusion and exclusion (Dolfsma & Dannreuther 2003).

As Levi-Strauss (1996) puts it: "to give is to receive". The literature on gifts, as well as empirical findings on gift exchange, show that those who give more are also the ones who receive more (Komter, 1996). Actors can try to shape their environment to become members of a group (inclusion) – giving them access to the benefits of social capital present in that particular group. Actors who are unable or unwilling to give, prove to be the poorest recipients (Komter, 1996) - both a cause and an effect for those individuals to have no social networks (Gouldner 1960). Komter (1996) has, consistent with the abovementioned, observed that "people seem to choose – probably mostly not consciously – those social

partners in their gift relationships who are attractive to them, because they can expect them to give in return at some time". Homans (1950, p.182) points out that "the higher a man's social rank, the larger will be the number of persons that originate interaction for him" (cf. Darr 2003). Bodemann (1988) point out that powerful people –being in a position where they can confer benefits to others – will receive more gifts than less powerful individuals, so that they might be more likely to reciprocate the focal agent. The (less-extended) social networks of less powerful or resource-poor individuals lead to less participation in gift exchange and diminishing opportunities to develop feelings of 'faithfulness and gratitude' (Simmel, 1996). Individuals may very well seek supportive relationships with network members who have different – not just more – resources (see, e.g., Lin and Dumin, 1986). Even though Mauss has stated that gifts should be accepted, there are ways a person may prevent from being offered one. Rejecting a gift publicly offered is an offense for both parties. Anticipating that a gift may not be accepted, signaling that a (particular kind of) gift will not be deemed appropriate, or that a particular giver if and when considering to offer a gift will not be admitted to a community prevents the gift from being offered in the first place and thus from having to reciprocate later. Such signaling prevents the establishment of a relation or inclusion into a Social Capital Community. Also: an exchange of gifts can start or go awry. As the gift signals the kind of person the giver is (or wants to be), the perception by the giver of the receiver, as well as the perception by the giver of the relationship as it exists or should develop, there is scope for misunderstandings to arise. Certainly because of the necessarily 'silent' nature of the gift. As Sherry (1983) points out: "those to whom we give differ from those to whom we do not give".

While trust can emerge and grow due to gift exchange, it can thus vanish as well: "Risk-taking and trusting behavior are thus really different sides of the same coin" (Deutsch 1958, p.266; cf. Mayer et al. 1995). Trust may be betrayed (Elangovan and Shapiro 1998), but if it works, transaction costs can go down substantially, conferring economic benefits to the parties involved as well as social ones (Dore 1983). If the wrong gift is offered in the wrong way, a relationship will not start off and an existing relationship can seize to exist, destroying all the social capital that existed between parties in the process. Not only will the parties involved miss out on a potentially lucrative relation, they may also lose 'face' (Smart 1993).

Knowing the right people and moving in the right circles is a good start but does not mean that one can use the social capital present (Ingram & Robert 2000). Social capital, as the discussion of gifts suggests, does not float around in the group, but exists between concrete individuals and are tangible expressions of their social relations (Sherry, 1983). One person is not generally in a position to profit from the social capital present in the relation between a second and third person. Gifts can be a medium through which social boundaries are expressed, frequently invoked in ritual (e.g. Smart 1993; Schneider, 1981 [from Sherry, 1983]; Dolfsma & Dannreuther 2003). Reciprocity in gift exchange should not be exclusively considered as affirming or reinforcing social networks (Komter 1996). Douglas and Isherwood (1979) succinctly observed that 'reciprocity in itself is a principle of exclusion'. Inappropriate gifts, inappropriately given gifts, or inappropriate givers can

therefore lead to exclusion from or can prevent the inclusion into a Social Capital Community. Gifts or return-gifts that are too much out of balance can equally harm the relation.

Using Social Capital

Gift exchange not only initiates and facilitates the exchange of resources it also affects the realm of social relations. Gift exchange, if and when performed using the appropriate rituals, establishes and maintains relationships between individuals. The social capital that inheres in these ties and relationships between actors can be **appropriated** for different purposes. Being connected is a resource in itself since people are able to make use of their connection to obtain other benefits. An important mechanism that underlies this aspect of social capital is reciprocity which was shown to be an important element of gift exchange. Reciprocity is seen to strengthen the rights of the provider to call upon the receiver and the obligation of the latter to provide it at some future point (Blehr, 1974; Uehara, 1990). Or as Sherry (1983) formulates it "to avoid feeling inferior and to safeguard reputation, the recipient must reciprocate. Failure to reciprocate appropriately can result in an asymmetrical relationship". The need to reciprocate may be seen as an outstanding obligation by the receiver to the giver, that are created between gift exchanging individuals, which according to Coleman (1990) can be considered as credit slips which can be put to use when the actor requires its use. These 'credit slips' or obligations then facilitate the mobilization of concomitant benefits and resources and appropriation of existing ties and relationships. In determining whether the resources could be called upon in practice, Coleman identifies two 'crucial' context specific elements namely the 'actual extent of obligations held' and 'the level of trustworthiness of the social environment'.

Burt (1992), however, concludes that trust is an essential characteristic of obligations since we never know a debt is recognized until the trusted person reciprocates. At some point, somehow, failure to reciprocate may well, however, entail excommunication. Burt emphasizes that there is a limit to the extent to which generalized reciprocity (Levi-Strauss, 1996; 1969; Ekeh, 1974),[25] can be expected to operate within a community. We are not denying that generalized reciprocity matters, but, as for instance studies of the development Open Source Software has indicated (Lakhami & Von Hippel 2003) generalized reciprocity is likely to be circumscribed and less powerful in eliciting the help of others than direct reciprocity (Bourdieu, 1977; Gouldner, 1960; Wilke & Lanzetta, 1970; Regan, 1971; Mauss, 1954).[26] The likelihood for reciprocity to occur is, ceteris paribus other relevant characteristics of the relationships involved, expected to the higher in case of direct reciprocity as compared to generalized reciprocity. At the same time, the literature on gifts indicates that, from the perspective of the members of a community, there needs to be some

25 In line with the discussion in the appendix, generalized reciprocity is a situation in which individual A presents a gift or favor to individual B but is reciprocated by a third individual C making reciprocity indirect or mediated.

26 In line with the discussion in the appendix direct reciprocity is a situation in which individual A gives to and is reciprocated by individual B; in contrast to generalized reciprocity individual B is now personally indebted to individual A (Levi-Strauss, 1996; 1969; Ekeh, 1974).

balance in the relationship (Sahlins, 1972; Walster, et al., 1973; Adams, 1965; Blau, 1968; Homans, 1974). New members have not contributed to the community to the same extent as established members have and as a result their credit with and reputation thereof is limited. A person whose position in a community is not established yet will receive gifts, largely due to the existence of generalized reciprocity in that community, but not to the same extent and of the same kind that more established members do.

As a counter-gift cannot be (legally) demanded, it may then matter crucially *how* relations in a Social Capital Community are drawn on to elicit a particular counter-gift if and when needed.

3.4 Discussion: no black box, no black hole

Emerson (1981) and Gouldner (1960) conceive exchange relationships as being predicated upon dependence of two parties on each other's resources. In a situation of dispersed resources, exchange becomes a necessary condition for resource combination (Moran & Ghosal, 1996; Nahapiet & Ghosal, 1998; Tsai & Ghosal, 1998). Bargaining power of participants will vary according to alternatives sources of supply open to them (e.g. Heath, 1976). The giving of gifts is a way of conferring material benefit on each other (Sherry, 1983). Ostensibly, there is no expectation of equivalent and formal return ([Beals, 1970] from Sherry, 1983). According to Mauss, people of a community must give, accept or receive a gift, and they must reciprocate. Counter-gifts must not be immediate and of the same value as that would turn a gift exchange a market exchange, and might turn the gift into a bribe. Again ostensibly, the act of giving takes precedence over the gift itself; acknowledgement of the gift invariably involves reference to the value and benefit of the gift (Sherry, 1983). The value of a gift is not necessarily defined by the price in the marketplace but is likely just as much to be a reflection of factors other than the ones one associates with the market place such as scarcity, monetary price and alternative sources of supply (Belk & Coon, 1993).[27]

Gift exchange can lead to lower transaction costs since it allows individuals to trade with one another without relying solely on formal mechanisms such as legal contracts and litigation. In the process of exchanging gifts, both parties get to know each other and the other's perceptions and frame of reference. It is believed by most exchange theorists that actors will engage in gift exchange if both parties believe that exchange provides them with more utility (satisfaction) than any other option currently open to them (Uehara, 1990). Offer (1997) and Ferrary (2003) point out that under certain circumstances reciprocal exchange, without the presence of a contract or financial compensation is preferred. Firstly, not all goods exchanged are merchandisable in the sense that their circulation cannot be transmitted via the market with a commercial contract and a monetary counter payment (for example certain types of information). Secondly, reciprocal exchange has been preferred when trade involves a personal interaction, and when goods or services are unique, expensive or have

27 Appendix I presents a more formalized discussion on this, based on Boulding (1981).

many dimensions of quality.

The notion of gift exchange opens up the black box of social capital. Discussing social capital as the result of gift exchange, allows one to understand how social capital is created, maintained and used. This, in turn, makes clear what can and what cannot be usefully attributed to social capital and that, hence, not all good (or bad) can be ascribed to it, almost at will, thus turning the concept into a black hole. The phenomena of gift exchange shows that the social and the economic sphere should not be conceived of as separate spheres – spheres overlap and are interrelated, and motives for gift exchange are both instrumental and (much) less self-interested (Dolfsma, Finch & McMaster 2005). Through gift exchange one may initiate and maintain relationships, as (mutual) obligations are created in its process. As a corollary of the cycle of giving and reciprocating, trust emerges and cooperation between the (exchange) parties involved is more likely to take root (Sahlins, 1972; Mauss, 1954; Gouldner, 1960; Uehara, 1990). As such, these benefits ascribed to social capital can now be properly understood.

Gift exchange creates and maintains social capital as a gift requires the receiver to give in return. Relationships between individuals are formed and sustained through the perpetual cycle of giving and receiving (Ruth et al., 1999). Frequent gift or favor exchanges lead to positive emotions and reduces uncertainty, generating cohesion and commitment (Lawler et al., 2000). Repeated social interactions – only possible if the cycle is not obviously broken – makes it possible for trust to develop (Landry et al., 2002; Tsai & Ghosal, 1998; Adler, 2001; Williamson, 1993). The indebtedness of others to the focal actor allows him to call in favors from those who are indebted to him. However, the exact nature of the counter gift, nor the moment at which it occurs, can be fully determined by the focal agent. No formal, enforceable agreement is involved; if there would be such an enforceable agreement, one would have to speak of a market transaction with a different dynamic. Building a new Social Capital Community, or extending an existing one, requires protracted investments in the form of gift exchange between individuals. Gift exchange only occurs when both parties are willing and able to give, receive and reciprocate resources in a broad sense of the term, however. If gifts are not returned, if inappropriate gifts are given in an inappropriate manner, or if too much or not enough is given, the relationship created and sustained by gift exchange can break down and people can be excluded from a Social Capital Community. Thus, in time, social capital is created and sustained by gift exchange, but at the same time, once created, social capital facilitates exchange of both gifts and market commodities particularly in uncertain circumstances (Bourdieu, 1986; Nahapiet & Ghosal, 1998).

3.5 Some Implications for Empirical Research

Even though the thrust of the argument in this paper, drawing largely on the anthropological literature on gift exchange, has been that one needs to understand the importance of the frame of reference people in a Social Capital Community entertain, this does not mean that the anthropologists' tool-kit is the only tool-kit for doing empirical research. Certainly, ethnographic research of the kind that Marcel Mauss, Claude Levi-Strauss, Mary Douglass

and many others have undertaken to provide 'thick descriptions' (Geertz 1973) is of great use, but other methods of research are as well. Flynn (2003) has shown how the extent to which people subjectively feel they 'owe' others can explain their (gifting) behavior in a community. Surveys can thus be used too. A third method that will provide useful insights, perhaps of a theoretical nature in particular, is that of the controlled experiment (Burgess & Nielsen, 1974; Greenberg & Frisch, 1972; Pruitt, 1968; Lawler & Yoon, 1998). Each of these methods will illuminate different but related aspects of the process of gift exchange and emergence or decay of social capital, thus opening its black box and revealing why it is not a black hole.

References

Abreu, D. (1988) 'On the Theory of Infinitely Repeated Games with Discounting' *Econometrica*, 56(2), 383-396.

Adam, F. & Roncevic, B. (2003) 'Social Capital: recent debates and research trends', *Social Science Information*, 42(2), 155-183.

Adams, J.S. (1965), 'Inequity in social exchange', *In: Advances in experimental social psychology.,* Ed. Berkowitz, L., New York: Academic Press

Adler, P. & Kwon, S.W. (2000) 'Social Capital: The Good, the Bad and the Ugly' i*n: Knowledge and Social Capital: foundations and applications*, Ed. Lesser, E. L. Butterworth, Heinemann: Boston.

Adler, P.S. (2001) 'Market, Hierarchy, and Trust: The Knowledge Economy, and the Future of Capitalism' *Organization Science*, 12(2): 215-234.

Adler, P.S., & Kwon, S.W. (2002) 'Social capital: prospects for a new concept', *Academy of Management Review* 27(1): 17-40.

Axelrod, R. (1984), *The Evolution of Cooperation*, New York: Basic Books

Beals, R. (1970) 'Gifting, Reciprocity, Savings and Credit in Peasant Oaxaca' *Southwestern Journal of Anthropology*, 26(3): 231-241.

Belk, R. (1979) 'Gift-Giving behavior', In: *Research in Marketing Volume 2*, Ed. Sheth, J., Greenwich, CT: JAI Press.

Belk, R.W., & Coon, G.S. (1993) 'Gift Giving as Agapic Love: An Alternative to the exchange paradigm based on dating experiences., *Journal of Consumer Research,* 20*,* 393-417.

Blau, P. (1964) *Exchange and Power in Social Life*, New York: Wiley.

Blau, P. (1968) 'Social Exchange', *In: International Encyclopedia of the Social Sciences vol. 7*, Ed Sills, D.S., New York: Macmillan

Blehr, O. (1974) 'Social Drinking in the Faroe Islands: The Ritual Aspect of Token Prestations', *Ethnos*, 39(1), 53-62.

Bodemann, Y.M. (1988), 'Relations of Production and Class Rule: The Hidden Basis of Patron-Clientage.', *In: Social Structures: A Network Approach,* Eds. Wellmann, B. & Berkowitz, S.D., Cambridge: Cambridge UP.

Boulding, K.E. (1962) "Notes on a Theory of Philanthropy" In: F.G. Dickinson (ed.) *Philanthropy and Public Policy*. New York: NBER, pp.57-71.

Boulding, K.E. (1981) A Preface to Grants Economics – The Economics of Love and Fear. New York: Praeger.

Bourdieu, P. (1977), *Outline of a Theory in Practice*, Cambridge University Press: Cambridge.

Bourdieu, P. (1986), 'Forms of Capital', *In: Handbook of Theory and Research for the Sociology of Education.* Ed. Richardson, J. G., New York: Greenwood Press.

Bradach, J.L. & Eccles, R.G. (1989), 'Market versus Hierarchies: From ideal types to plural forms', in R. Th. A.J. Leenders and S.M. Gabbay (eds), *Corporate Social Capital and Liability*, Dordrecht: Kluwer, pp.97-118

Burgess, R., & Nielsen, J. (1974), 'An experimental analysis of some structural determinants of equitable and inequitable exchange relations', *American Sociological Review*, 39, pp. 427-443

Burt, R.S. (1992), 'Structural holes: The social structure of competition', Cambridge, MA: Harvard UP.

Carrier, J. (1991), 'Gifts, Commodities, and Social Relations: A Maussian View of Exchange', *Sociological Forum* 6(1): 119-136.

Cheal, D. (1988) *The Gift Economy.* Routledge: London and New York

Child, J. and D. Faulkner (1998) Strategies of Cooperation: Managing alliances, networks and joint ventures. Oxford: Oxford UP.

Cicourel, A. (1973) Cognitive sociology: Language and meaning in social interaction, Harmondsworth, England: Penguin Books.

Coleman, J.S. (1988) 'Social Capital: in the creation of Human Capital' *American Journal of Sociology*, 94 Supplement, S95-S120.

Coleman, J.S. (1994) *'Foundations of Social Theory'* Cambridge MA: Belknap Press.

Cook, K. & Emerson, R. (1984) 'Exchange Networks and the Analysis of Complex Organizations', *In: Research on the sociology of organizations.* Eds. Bacharach, S. & Lawler, E., Greenwich, CT: JAI Press.

Darr, A. (2003) 'Gifting Practices and Inter-organizational Relations: Constructing Obligations Networks in the Electronics Sector', *Sociological Forum*, 18(1), 31-51.
Deal, T.E. & Kennedy, A.A. (1982) *Corporate Cultures: the rites and rituals of corporate life*. Reading, Mass.: Addison-Wesley.
Deckop, J.R., Cirka, C.C., & Andersson, L.M. (2003), 'Doing Unto Others: The Reciprocity of Helping Behavior in Organizations', *Journal of Business Ethics*, 47, 101-113.
Deutsch, M. (1958) "Trust and Suspicion" *Journal of Conflict Resolution* 2(4): 265-279.
Dika, S. & Singh, K. (2002) 'Applications of Social Capital in Educational Literature: A Critical Synthesis.', *Review of Educational Research,* 72 (1)*,* 31-60.
Dolfsma, W. (2001) "Metaphors of Knowledge in Economics" *Review of Social Economy* 59(1): 71-91.
Dolfsma, W. and C. Dannreuther (2003) "Subjects and Boundaries: Contesting social capital-based policies" *Journal of Economic Issues* 37(2): 405-413.
Dolfsma, W., J. Finch & R. McMaster (2005) "Market and Society: (how) do they relate, and contribute to welfare?" *Journal of Economic Issues* 39(2): 347-356.
Dore, R. (1983) "Goodwill and the spirit of market capitalism" *British Journal of Sociology* 34(4): 459-482.
Douglas, M. & Isherwood, B. (1979) *The World of Goods*, New York: Basic Books.
The Economist (2006) The business of giving – a survey of wealth and philanthropy. February 25.
Ekeh, P.P. (1974), *Social Exchange Theory: The Two Traditions*, Cambridge Mass: Harvard University Press
Ekelund, R.B., R.F. Hébert, R.D. Tollison, G.M. Anderson and A.B. Davidson (1996) *Sacred Trust – The Medieval Church as an Economic Firm*. New York: Oxford University Press.
Elangovan, A.K. and D.L. Shapiro (1998) "Betrayal of Trust in Organization" *Academy of Management Review* 23(3): 547-566.
Emerson, R.M. (1981) 'Social Exchange Theory.', *In: Social Psychology: Sociological Perspective*, Eds. Rosenberg, M. & Turner, R., New York: Basic Books.
Frank, R.H. (1988), Passions Within Reason, the Strategic Role of the Emotions, New York: W.W. Norton
Ferrary, M. (2003) 'The Gift Exchange in the Social Networks of Silicon Valley', *California Management Review* 45(4): 120-138
Field, J. (2003) *Social Capital*, London and New York: Routledge.
Fine, B. (2000) 'Social Capital versus Social Theory. Political Economy and Social Science at the Turn of the Millennium', London and New York: Routledge.
Flynn, F.J. (2003) "How much should I give and how often? The effects of generosity and frequency of favor exchange on social status and productivity" *Academy of Management Journal* 46(5): 539-553.
Foley, M. & Edwards, B (1997), 'Escape from politics? Social Theory and the Social Capital Debate', *American Behavioral Scientist,* 40 (5)*,* 550-561.
Foley, M. & Edwards, B (1999), 'Is it time to Divest in Social Capital?', *Journal of Public Policy*, 19 (2), 141-173.
Fudenberg, D., & Maskin, E. (1986), 'The Folk Theorem in Repeated Games with Discounting or with Incomplete Information '
Econometrica, 54(3), 533-554.
Fukuyama, F. (1997) Social capital and the modern capitalist economy: Creating a trust workplace, Stern Business.
Geertz, C. (1973) *The Interpretation of Cultures*. New York: Basic Books.
Gouldner, A.W. (1960) 'The Norm of Reciprocity: A preliminary statement', *American Sociological Review* 25: 161-178.
Granovetter, M. (1985) "Economic Action and Social Structure: The Problem of Embeddedness" *American Journal of Sociology* 91(November): 481-510.
Granovetter, M.S. (1992) 'Problems of explanations in economic sociology', *In: Networks and organizations: Structure, form and action*, Eds. Nohria, N. & Eccles, R., Boston: Harvard Business School.
Greenberg, M.S., & Frisch, D.M. (1972),' Effect of Intentionality on Willingness to Reciprocate a Favor', *Journal*

of Experimental Social Psychology, 8, pp. 99-111
Hansen, M. (1999) "The search-transfer problem: The role of weak ties in sharing knowledge across organization subunits" Administrative Science Quarterly 44: 82-111.
Heath, A.F. (1976) Rational Choice and Social Exchange: A critique of Exchange Theory, Cambridge UP.
Heide, J.B. & Miner, A.S. (1992), 'The shadow of the future: Effects of anticipated interaction and frequency of contact on buyer-seller cooperation', Academy of Management Review, 35: 265-291
Hill, C.W.L. (1990), Cooperation, opportunism and the invisible hand: Implications for transaction cost theory', *Academy of Management Review*, 15/3: 500-513
Homans, G.C. (1950) *The Human Group*, New York: Harcourt, Brace.
Homans, G.C. (1974) *Social Behavior: Its elementary Forms*, New York: Harcourt Brace Jovanoviech.
Humphrey, C & Hugh-Jones, S. (1992) *Barter, Exchange and Value*, Cambridge, UK Cambridge UP.
Ingram, P. & P.W. Robert (2000) "Friendship among competitors in the Sydney Hotel Industry" *American Journal of Sociology* 106: 387-423.
Jackman, R. W. & R. A. Miller (1998) 'Social Capital and Politics', *Annual Review of Political Science* 1: 47-73.
Khalil, E. (2004) "The Gift Paradox: Complex selves and symbolic goods" *Review of Social Economy* 62(3): 379-392.
Komter, A.E. (1996) *The Gift : An Interdisciplinary Approach*, Amsterdam: Amsterdam University Press.
Knoke, D. & Kuklinski, J.H. (1982) *Network Analysis*. Beverly Hills: Sage.
Kreps, D.M. (1990) 'Corporate culture and economic theory', *In: Perspectives on Political Economy*, Eds. Alt, J & Shepsel, K.
Cambridge UP.
Kreps, D., Milgrom, P., & Wilson, R. (1982) 'Rational Cooperation in the Finitely Repeated Prisoner's Dilemma' *Journal of*
Economic Theory, 27*,* 245-252.
Lakhani, K.R. and E. von Hippel (2003) "How Open Source Software Works: "Free" User-to-User Assistance," *Research Policy*
32(6): 923-943.
Landry, R., N. Amara & M. Lamari (2001) "Utilization of social science research knowledge in Canada" *Research Policy* 30(2):
333-349.
Larsen, D. & J.J. Watson (2001) "A guide map to the terrain of gift value," *Psychology & Marketing* 18: 889-906.
Laumann, E.O. & F.U. Pappi (1976) *Networks of Collective Action*. New York: Academic Press.
Lawler, E.J., J. Yoon & S.R. Thye (2000) "Emotion and Group Cohesion in Productive Exchange." *American Journal of Sociology* 106: 616-657.
Lawler, E.J., Yoon, J. (1998),'Network Structure and Emotion in Exchange Relations', *American Sociological Review*, 63(6), pp.871-894
Levi-Strauss, C (1996) 'The principle of reciprocity', *In: The Gift: An Interdisciplinary Perspective,* Ed. Komter, A.E. , Amsterdam: Amsterdam University Press.
Levi-Strauss, C (1969) '*The Elementary Structures of Kinship'*, Boston Beacon
Lin, N., & Dumin, M. (1986) 'Access to occupations through social ties', *Social Networks*: 25: 467-487.
Malinowski, B. (1996) 'The Principle of Give and Take', *In: The Gift: An Interdisciplinary Perspective,* Ed. Komter, A.E., Amsterdam: Amsterdam University Press
Mauss, M. (1954 [2000]) The Gift: Forms and Functions of Exchange in Archaic Societies., New York: Norton
Mayer, R.C., J.H. Davis and F.D. Schoorman (1995) "An integrative model of organizational trust" *Academy of Management Review* 20(3): 709-734.
McGrath, M.A. & Englis, B. (1996) 'Intergenerational Gift Giving in Sub-cultural Wedding Celebrations: The Ritual Audience As Cash Cow', *In: Gift Giving: A Research Anthology*, Ed. Otnes, C. & Beltramini, R.F., Bowling Green: Bowling Green State UP.

Nooteboom, B. (2002), *Trust: Form, Foundations, Functions, Failures and Figures*, Cheltenham: Edgar Elgar Publishing.
Moran, P., & Ghosal, S. (1996) 'Value creation by firms', *In: Academy of Management Best Paper Proceedings,* Eds. Keys, J.B. & Dosier, L.N.
Nahapiet, J., & Ghosal, S. (1998) 'Social capital, intellectual capital, and the organizational advantage', *Academy of Management Review,* 23(20)*,* 242-266.
Nye, F, I. (1979), 'Choice, Exchange and the Family', *In: Contemporary Theories about the Family,* Eds. Burr, W.R. et al., New York: Free Press.
Offer, A. (1997), 'Between the Gift and the Market: The Economy of Regard', *The Economic History Review,* 50(3), 450-476.
Ostrom, E. and T.K. Ahn, eds. (2003) *Foundations of Social Capital*. Northampton: Edward Elgar.
Paldam, M. & Svendsen, G. T. (2000), 'An Essay on Social Capital: Looking for the fire behind the smoke', *European Journal of Political Economy*, 16, 339-366.
Parkhe, A. (1993), 'Strategic alliance structuring: A game theoretic and transaction cost examination of inter-firm cooperation', Academy of Management Journal, 36: 794-829
Portes, A. (1998) "Social capital: Its origins and applications in modern sociology" *Annual Review of Sociology* 24: 1-24.
Portes, A. & Sensenbrenner, J. (1993), 'Embeddedness and immigration: notes on the social determinants of economic action', *American Journal of Sociology,* 98, 1320-1350.
Pruitt, D.G. (1968),'Reciprocity and credit building in a laboratory dyad', *Journal of Personality and Social Psychology'*, 8, pp.143-147
Putnam, R.D. (1993) Making Democracy Work: Civic Traditions in Modern Italy., Princeton, NJ: Princeton UP.
Regan D.T. (1971), 'Effects of a Favor and Liking on Compliance', *Journal of Experimental Social Psychology*, 7, pp. 627-639
Rose-Ackerman, S. (1998) 'Bribes and Gifts', *In: Economics, values and organization,* Eds. Ben-ner, A & Putterman, L., Cambridge UP.
Ruth, J.A., Otnes, C.C., & Brunel, F.F. (1999) 'Gift receipt and the reformulation of interpersonal Relationships', *Journal of Consumer Research*, 25(4), 385-402
Sahlins, M.B. (1972) Stone Age Economics. Chicago: Aldine.
Sandefur, R.L. & Laumann, E.O. (1998) 'A paradigm for social capital', *In: Knowledge and Social Capital: foundations and Applications*, Ed. Lesser, E. L., Butterworth Heinemann: Boston.
Schein, E.H. (1965) *Organization Psychology,* New York: Prentice-Hall, Englewood Cliffs.
Schwartz, B. (1996) 'The Social Psychology of the Gift', *In: The Gift: An Interdisciplinary Perspective,* Ed. Komter, A.E., Amsterdam: Amsterdam University Press.
Scott, J. (1991) Social network analyses: A handbook. London: Sage.
Shapiro, S.P. (1987), 'The social control of impersonal trust', *American Journal of Sociology*, 93: 623-658
Sherry, J.F. (1983), 'Gift Giving in Anthropological Perspective' *Journal of Consumer Research* 10(2): 157-168.
Simmel, G. (1996) 'Faithfulness and Gratitude', *In: The Gift: An Interdisciplinary Perspective*, Ed. Komter, A.E., Amsterdam: Amsterdam University Press.
Smart, A. (1993) 'Gifts, Bribes, and Guanxi: A reconsideration of Bourdieu's Social Capital', *Cultural Anthropology* 8(3): 388-408.
Telser, L.G. (1980), 'A theory of self-enforcing agreements', *Journal of Business*, 53: 27-44
Tsai, W. & Ghosal, S. (1998) 'Social Capital and Value Creation: The role of intra firm networks', *Academy of Management Journal* 41 (4)*,* 464-476.
Uehara, E. (1990) 'Dual Exchange Theory, Social Networks, and Informational Support', *The American Journal of Sociology* 96: 521-557.
Ullman-Margalit, E. (1978), "Invisible-hand explanations", *Synthesis* 39: 263-91.
Von Krogh, G. (1998) "Care in Knowledge Creation" *California Management Review* 40(3): 133-153.
Walster, E., Berscheid, E. & & Walster, G.W. (1976), 'New Directions in Equity Research', *In: Equity Theory:*

Towards a General Theory of Social Interaction., Eds. Berkowitz, L. & Walster, E., New York: Academic Press

Wasserman, S., & Faust, K. (1994) *Social Network Analysis: Methods and Applications.,* Cambridge, England: Cambridge UP.

Weigelt, K. & Camerer, C. (1988), 'Reputation and corporate strategy: A review of recent theory and applications', *Strategic Management Journal*, 9: 443-454

Wilke, H., & Lanzetta, J.T. (1970), 'The Obligation to Help: The Effects of the Amount of Prior Help on Subsequent Helping Behavior', *Journal of Experimental Social Psychology*, 6, pp. 488-493

Williamson, O,E., (1985), The Economic Institutions of Capitalism: Firm Markets, Relational Contracting, New York: The Free Press

Williamson, O.E., (1993) 'Calculativeness, Trust, And Economic Organization', *Journal of Law and Economics,* 36*,* 159-502.

Woolcock, M. (1998) "Social Capital and Economic Development: towards a Theoretical synthesis and policy framework", *Theory and Society* 27(2): 151-208.

Zeitlyn, D. (2003) "Gift economies in the development of open source software" *Research Policy* 32(7): 1287-1291.

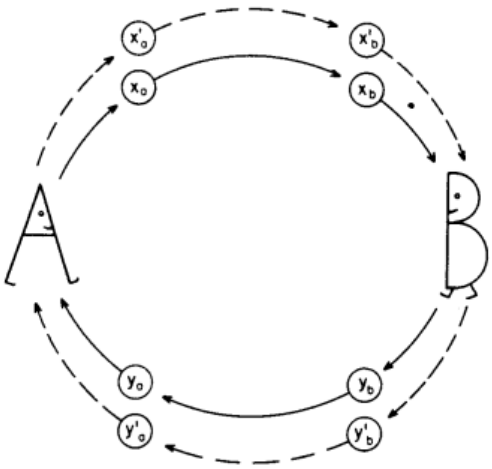
Zelizer, Viviana A. (1997) *The Social Meaning of Money*. Princeton, NJ: Princeton University Press.

Zucker, L.G. (1986) 'Production of trust: Institutional sources of economic structure, 1840-1920.' *Research in Organizational Behavior* 8: 53-111.

Appendix A

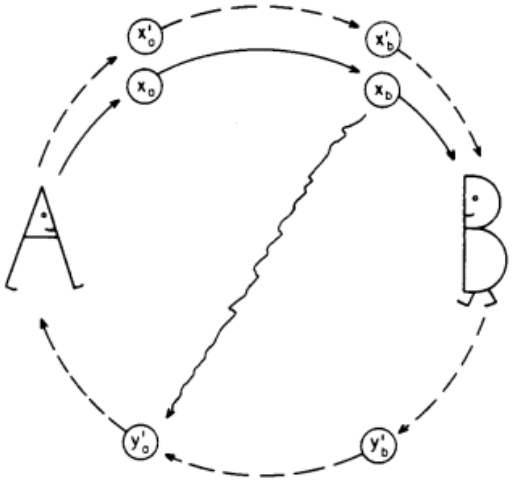
It is instructive to consider Boulding's (1981) formalization of the exchange of gifts (grants, as he calls them). He considers two individuals (A and B) exchanging two different goods (x and y, respectively). These x's and y's may be commodities, money, but may also represent "communications, information, threats, promises, affirmations, persuasions, and so on" (Boulding 1981, p.19). A sends out something, x, which he perceives as sending x_a, to B; B, similarly, may send something, y, which she perceives as sending y_b to A. When x_a and y_b arrive at B respectively A, they may be (perceived of as) different from what was intended: x_b and y_a. When there is a simultaneous exchange of commodities, a 'complete' market exchange emerges. In such a 'simple' market exchange, it may be unproblematic to assume that $x_a = x_b$ and $y_b = y_a$; only the solid arrows of Figure 1 need be considered. Such alignment of perceptions may not occur. Indeed, as Boulding (1981, p.21) argues: "in many forms, even in commodity exchange, the difference between x_a and x_b and between y_b and y_a may be of great significance." In many exchanges, then, flows of information and communication are involved: $x'_a\ x'_b$ and $y'_b\ y'_a$ – the dashed lines.

Figure 3-1 'Simple' Market Exchange (Boulding 1981)



The gift is then that exchange in which one of the commodity flows is zero, for instance $y_b = y_a = 0$. This is presented in Figure 2. At some later occasion, A will expect B to reciprocate, but reciprocation may not occur and the value of that which is reciprocated may not 'objectively' be similar or the same. There is, thus, considerable uncertainty involved in gift exchange.

Figure 3-2 Gift Exchange (Boulding, 1981)



To the extent that gift exchange is instrumental, and thus motivated by self-interest, we may assume that some sense of a terms of trade (T) between A and B will play a role. If *v* is the quantity of x exchanged, and *u* the quantity of y, then the terms of trade for A in case of a gift from A to B will be T_a:

$$T_a = \frac{(y'_a u'_a)}{(x_a v_a) + (x'_b v'_b)} \quad \text{(Equation A-1)}$$

The terms of trade for B can be determined by analogy.[28] One would then expect, pace Boulding and others who have emphasized the instrumental nature of gift exchange as mentioned in the main body of the paper, that both A and B will only engage in gift exchange iff: Ta, Tb ≥ 1. Part of the exchange, incorporated in $y'_a\ y'_b$ is the promise or obligation of a counter-gift. The original gift will be given in the expectation of a counter-gift to come, and B will communicate to A that one it to be expected. Gift exchange will go awry if and when either the perception by B of good x given by A to B (x_b) or the understanding by A of the signals from B (y'_b) are misguided. In a knowledge economy, information-communication can in fact be what is expected as a counter-gift; in the present framework, consistent with Bouling's argument, this would be $y_b\ y_a$ and not $y'_a\ y'_b$. Assuming continued interaction, at some later moment in time, another exchange similar to that of Figure A-2 will occur, in opposite direction.

28 The discussion presupposes cardinal utility or an objective determination of value, but, according to Boulding (1962), one can reformulate in terms of ordinal utility or (inter-) subjective value.

Chapter 4
Open Innovation:
Knowledge, Networks and Gift Exchange [29,30]

4.1 Introduction

Increasingly economies are seen as knowledge economies; intangible assets such as knowledge and information have become increasingly important for economic dynamics. Innovation still remains an elusive concept however. While some 30 years ago the innovation process was thought to consist of a number of linear, sequential stages, more recently it is thought to be an interactive process where knowledge is exchanged in a context of more or less stable relations (Autio et al. 2004; Landry et al. 2002). Chesbrough (2003a) has made a strong argument that firms should conceive of their innovation processes as engaging beyond the boundaries of the division or even the firm. This paper explores the conceptual implications of this observation for conceiving how persons in an organization will share knowledge both within as well as across firm boundaries, and thus complements the more strategic issues in this discussion about 'open innovation' (cf. Chesbrough 2003a, 2003b; Henkel 2006).

The burgeoning literature on open innovation has so far not looked into the intricacies of individuals sharing knowledge. A shifting 'locus of innovation' (von Hippel 2003b, p.39) will not leave the interactions between persons, as members of departments or of firms, unaffected: how can the interactions they have within and across firm boundaries be understood? Social network analysis (SNA) offers insights into knowledge transfer as it explores network structure and network position (Coleman, Katz, and Menzel, 1966; Gabbay & Zuckerman, 1998; Galunic & Moran, 2000; Hansen, 1999; Landry et al., 2002; Nahaphiet & Ghosal, 1998; Allen & Cohen, 1969; Allen, 1977; Tushman, 1978; Tushman & Scalan, 1981; Burt, 1992, 2004).

Despite these contributions several unanswered questions remain. Especially the micro processes of socially sharing knowledge need further exploration (Tsai, 2000; Kim & Mauborgne, 1998; Darr, Argote & Epple, 1995; and particularly Obstfeld, 2005), and particularly in the domain of open innovation (von Hippel 1987; Henkel 2006; Lakhani & von Hippel). The almost exclusive focus on structural aspects of relations between individuals, to the neglect of substantive matters related to the relations individuals maintain, needs to be addressed if OI is to be understood. The "action problem" Obstfeld (2005) identified must be addressed: why, when and how will people in a network actually act, share knowledge, using the network structure that is there.

We will discuss the extraordinary characteristics of knowledge in this context.

29 We would like to thank Ferdinand Jaspers, Albert Jolink, participants in a seminar at RSM Erasmus University, and two referees for this journal for comments. Disclaimer.

30 Rene van der Eijk & Wilfred Dolfsma

Social network literature can and does explain knowledge transfer between individuals to a considerable degree, as we show. We offer a solution to the action problem faced by this literature by offering the *concept* of gift exchange. A means of creating and maintaining social ties, gift explains why individuals engage in exchange, how relations are sustained and will be used when knowledge transfer is explored.

4.2 Knowledge creation and knowledge characteristics

The idea that the innovation development process can be understood as a process that to a large extend is fueled by social relationships is closely related to Schumpeter's (1934) idea that innovations are new combinations of existing knowledge and incremental learning. Extending Schumpeter's view on innovation, Burt (2004) has shown that being in a position where one receives and transfers knowledge will also allow you to actually be (more) creative yourself. Cooperation involving a number of actors who each are dependent on others is entailed. This is not uncommon within organizations, and is in part what organizations are there for (Lopes & Castro Caldas 2008). The exchange of knowledge is different for a number of reasons that we will elaborate upon below (cf. von Krogh 1998). Knowledge exchange may be less obvious then the exchange of more tangible resources (Szulanski 1996). We focus on knowledge transfer between persons that is not mandated by formal instruction (hierarchy) nor contractually obliged (market). When referring to knowledge and knowledge transfer, we refer to both knowledge newly developed for the relevant context, or existing knowledge that can be the basis for new goods or subsequent new insights.
We identify four characteristics of knowledge which affect the way in which it is transfered, and especially in the context of OI.

Knowledge as a public good. Knowledge is a (quasi) public goods, in that it is non-exclusive: consumption or use by non-payers cannot be excluded. Knowledge is also non-rivalrous: they are not consumed by their use (Alder, 2001; Arrow, 1984). "Information [thus] is costly to produce but cheap to reproduce" (Shapiro et al. 1999, p21). As imitation or communication of intellectual objects is easy and cheap, there is a tendency for these goods to be under-produced (Nelson, 1959; Romer, 2002). Information and knowledge are faced with an information paradox (Arrow, 1971; Adler 2001). Prior to the acquisition of information the value to the buyer cannot be established. If the potential buyer is allowed to inspect the good so as to determine its value to her, there no longer is a need for her to actually buy it as the product cannot be repossessed after the inspection. Providing a sample of the good may mitigate the paradox, but only if the provider can be trusted to indicate exactly how representative the sample will be of the complete product. There will be a tendency for the provider to adversely select what to share with the buyer.

Knowledge as a cumulative good. The process of knowledge generation and the resulting technological advance for the most part is a cumulative process, where scientists draw on the work done (by others) in the past, and is generally based on the efforts of

many inventors and developers (Scotschmer 1991; Nelson 1959; Mokyr 2002). Knowledge generation requires that individuals have related knowledge; acquiring new knowledge involves tacit dimensions and requires coding and decoding (Polanyi 1966; Berger & Luckman 1967; Dolfsma 2008). This process involves the integration of this new knowledge into the existing larger framework of knowledge of the individual in which meaning is given to this new piece of information (Polanyi, 1966; Dolfsma, 2008). This means that actors find it easier to adopt and interpret knowledge that is "related" to their knowledge base (Markides & Williamson, 1994; Hansen, 2002). Accumulated stocks of knowledge are essential to the innovation development process first as a resource to directly develop innovations, and, secondly as a basis for absorbing new knowledge (Cohen & Levinthal, 1990; Markides & Williamson, 1994; Obstfeld, 2005; Hansen, 2002; Powell et al., 1996). The literature on technological paradigms has argued that what holds for individuals also applies to groups of individuals, for instance involved in the development of a technological field (Dosi 1982; De Poel *et al*. 2002; Mokyr 2002). Knowledge then, in the words of Isaac Newton, is developed while standing on the shoulders of giants (Merton 1965; Scotchmer 1991; Dolfsma, 2008).

Uncertainty. Obtaining a piece of existing or new knowledge is fraught with uncertainty, even when development of new technological knowledge is path dependent. Uncertainty of a technological nature is well documented, but uncertainty of a strategic nature is involved as well. Knowledge easily spills over unintentionally, and is in general a commodity the use and development of which is affected by opportunistic behavior of other parties, increasing associated transactions costs (Jones et al., 1997). As characteristics and value of the knowledge yet to be developed is impossible to determine beforehand, contracting for the complete set of future scenarios that may develop cannot be undertaken (Inkpen, 1996; Starpoli, 1998). Contracts drafted, monitoring, and litigation between agents offers even less solace in the case of knowledge than in general (Field, 2003; Hodgson 2005).

Knowledge communities. New knowledge is created in part as a result of the 'communities of practice', interactions between individuals who may or may not be members of the same organization (Wenger & Snyder, 2000; Brown & Duguid, 1991, 2001; Nonaka, 1994). Communities of practice, groups of actors ranging from a few individuals to several hundred members, interact on a regular basis to solve problems (Knight, 1967). Members build relationships of trust due to their affiliation and the engagement in common practices, they share similar interests and/or expertise (Wenger & Snyder, 2000; Wenger, 1998; Brown & Duguid, 1991; 2001). Communities of practice are thus repositories of social capital, facilitating exchange; they enable quick identification of and connection with individuals who have relevant knowledge. They are thus "significant repositories for the development, maintenance, and reproduction of knowledge" (Brown & Duguid, 2001; cf. Lesser 2000), allowing individual members to solve problems and transfer best practices (Wenger 1998). Although co-location is considered important for knowledge spillovers to occur (Decarolis & Deeds, 1999; Dar, Argote & Epple, 1995), communities of practices can also span

geographical distances (Agrawal et al., 2003; Brown & Duguid, 2001). Communities of practice tend to be associated with informal contacts between individuals (Dar, Argote & Epple, 1995; Furukawa & Goto, 2006; Park, 2002).

The exchange of knowledge between people is by no means an easy or self-evident process (Hansen 1999; Szulanski 1996, Winter & Szulanski 2001). For these reasons a number of scholars have, in the past, suggested that a mode of exchange and coordination different from that of market or hierarchy may be better suited for exchange of knowledge (Bradach & Eccles 1989; Dore 1983; Macaulay 1963; Ouchi, 1980; Powell 1991; Dolfsma & van der Eijk 2008). What such a mode of exchange would look like and how it would function was largely left unclear.

4.3 Social Network Literature

A networks is a set of relations linking actors (people or organizations), objects or events (Knoke & Kuklinski 1982; Scott, 1991; Wasserman & Faust, 1994). Social network theory assumes a structuralist position: actors are influenced by the social context in which they are embedded. The position of actors in a network as well as type and number of ties influence the actors' actions.

Social network literature holds that while knowledge may reside in individuals, it is through networks that knowledge is exchanged and can be both put to use and developed further (Allen, 1977; Tushman 1978; Tushman & Scanlan 1981; Rogers, 1995; Coleman, Katz and Menzel 1966). Network configurations and positions in the social network facilitate dissemination of information, and thus innovation. In line with what the literature on *communities-of-practice* suggests, social network theory indicates that, for instance, the shape of the network (its density, redundancy, clutsering, size) (Allen & Cohen 1969; Katz & Tushman 1981; Tsai 2001) or the position of individuals (centrality, tie strength) (Hansen, 1999; Uzzi, 1997; Reagans & McEvily, 2003; Granovetter, 1973; 1982) represent an important resource for knowledge creation. Others investigated the networks characterized as either high or low levels of redundancy. If redundancy is low, there may be many more weak ties that constitute the network, but there may also be loosely related subgroups in the network. Subgroups may be connected by structural holes that can exert great influence on the exchange (e.g. Burt, 1992; 2004). "Closed" or cohesive networks where redundancy is high cannot easily be controlled and are less likely to provide access to novel ideas, information and knowledge as the inflow of new ideas into a closed network is more limited than in a non-redundant network (Granovetter 1973). Such a network structure, usually marked by frequent communication and strong ties, does however, offer actors the benefits of cooperative, coordinated action (Granovetter 1985; Obstfeld 2005) and the ability and willingness to share complex knowledge as a shared frame of reference and trust may develop (Coleman 1988; Hansen, 1999; Uzzi, 1997; Reagans & McEvily, 2003; Walker et al. 1997). Transfer of tacit knowledge requires such close, personal interaction of individuals (Kogut & Zander 1992; Hansen 1999; Nonaka 1994; Polanyi 1966).

A network structure provides possibilities for actors to exchange with some actors and not with others (Skvoretz & Lovaglia 1995). Under-emphasizing the role of agency, social network literature suggests implicitly that the exchange of knowledge depends (only) on the 'pipes and prisms' of the network. Actors properly connected, it is assumed, will not be excluded from knowledge; there will be no rivalry in its use. Knowledge as a public good may be under-produced because a network is not properly configured. Indeed, SNA relies on the assumption that knowledge is a public good.

SNA does not discuss the content of what is transferred using the networks, and so may not seem to take a special position with regard to the *cumulative nature* of knowledge development. Relations between individuals are only the conduits through which knowledge and resources are exchanged (e.g. Podolny 2001; Tsai & Ghosal 1998; Owen-Smith & Powell 2004), although SNA, for instance, has shown that certain types of knowledge are best transferred through specific kinds of relations (Granovetter 1973; Hansen 1999; Uzzi 1997; Aalbers et al. 2006; Cross et al. 2002; Allen & Cohen 1969). Given the different strengths and weaknesses of the different network structures it is not surprising that subsequent research has taken a contingency approach emphasizing that different network structures are beneficial in different circumstances (e.g. Rowley, Behrens & Krackhardt 2000; Ahuja, 2000; Podolny, 2001).

Acknowledging a role for strategic uncertainty due to agents' behavior is problematic, however, within the SNA framework. Opportunistic behavior on the part of actors in a network, as a result of which knowledge may not be freely shared, is inexplicable for SNA. What may be claimed is that there is a *tendency* for certain kinds of behavior to be present in networks of a certain kind. In closed, dense network, where all the nodes are mutually connected, the risk of opportunistic behavior is lower due to emergence of enforceable norms (Coleman, 1988; Portes & Sensenbrenner, 1993) reputation effects (Kreps 1990; Ostrom and Ahn 2003; Coleman 1988; Sherry 1983; Ferrary 2003) and repeat-interaction effects (Abreu, 1998, Fudenberg & Maskin, 1986; Kreps et al., 1982).

If, therefore, certain knowledge is to be transferred *structural* conditions for doing so are known from SNA. The difficulties of the diffusion and further development of knowledge reach beyond the structural elements, however. While SNA theory has recognized the information and resource benefits of networks, it has not focused on motivational/ incentive issues (cf. Hansen 1999; Moran & Ghosal 1996; Van der Eijk et al. 2006). A more thorough understanding of the micro processes of socially sharing knowledge is needed (Tsai, 2000; Kim & Mauborgne, 1998; Darr, Argote & Epple, 1995; Obstfeld, 2005). Why actors supply or share knowledge, or how relations can get started, be mobilized and coordinated, has received little attention. A fuller understanding of these may inform new forms of HRM policies constructively (cf. Laursen & Foss 2003). Obstfeld (2005) has, thus, claimed, rightfully, that SNA has an action problem.

4.4 The Action Problem

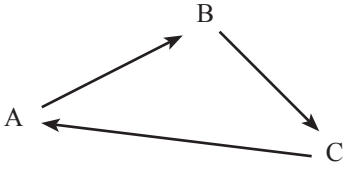
Whenever there are individuals who can achieve some common goal through cooperation, but who each have other goals as well that are not aligned with the shared goal nor with each others' additional goals, a potential problem of (collective) action exists. This action problem is the result of a potential conflict between the common interest and the interests of the individual (Olson 1965; Hardin 1968). To achieve a mutually beneficial form of cooperation partially overlapping goals need to be aligned and the actors' selfish incentives, the extent of which can vary, need to be overcome. This is what Obstfeld (2005) has dubbed the action problem for social network theory. The action problem actually consists of two parts: one is the problem that one cannot be sure that a specific other one is related to will act in the expected manner when required. A second sense in which the action problem can be interpreted relates to the behavior of others in the network, either directly identifyable or further removed (see Figure 1; cf. Ekeh 1974). Since SNA however has focused exclusively on structural elements, it cannot assume what it in fact does assume: that the social capital that inheres in a network can be drawn on at will (cf. Coleman 1988, Van der Eijk et al 2006).

Whenever achieving some goal involves the assistance of others, actors will still need to enlist the cooperation of other parties. In the context of innovations, for instance, relational ties and networks do play a crucial part in locating and accessing relevant knowledge. In actual fact actors find solutions for problems that theoretically are still puzzling. Coordinating intra- and even inter-organizational collaboration, despite possibly conflicting (organizational) goals and the threat of opportunistic behavior, and in the absence of coordination and/or regulation by external authority, does occur (Bouty 2000; Gulati & Singh, 1998; Ahuja, 2000).

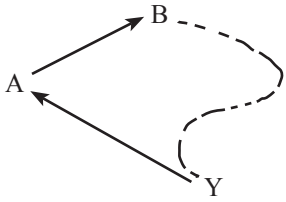
Figure 4-1 A Classification of Gift Exchange /Reciprocity

I: Direct:

II: Generalized (indirect):



III: Generalized (community; “Pay it Forward”)



As Huysman and de Wit (2004) point out “Knowledge sharing cannot be forced; people will only share knowledge if there is a personal reason to do so” due to the kind of good knowledge is (e.g. Wenger & Snyder, 2000; Wenger, 1998; Brown & Duguid, 1991; 2001). Why do individuals, in the absence of clearly defined, formal, enforceable obligations, feel compelled to (continue to) provide recipients with knowledge?

4.5 Gift /Favor exchange

For innovation it is clear that the flow of knowledge between agents within the same and in different organisations is required. The flow of knowledge even within a single organization is far from obvious (e.g. Ghosal & Barlett 1988; Kogut & Zander 1992; Hansen 1999; Szulanski 1996; Cross et al. 2001; Szulanski & Winter 2001). Knowledge may be present with actors in a network but not be transferred for a number of reasons, contrary to what SNA implicitly assumes. Actors may not want to exchange knowledge, or may not know about the need that others have for knowledge.

We have argued earlier (Van der Eijk et al. 2006; cf Flynn 2003, Dolfsma 2008b) that the literature discussing cooperation where direction in a hierarchical setting or through the market cannot be relied on is rather unsatisfactory. The notion of gift exchange provides an explanation of how actors are able to solicit the cooperation and exchange of knowledge from people within their network as well as from people beyond it. There have been earlier suggestions to invoke this literature (Zeitlyn 2003), but never has there been an extensive argument for it.

Gift exchange theory offers insight into a wide variety of contexts (e.g., Blau 1964, Heath 1976; Homans 1974; Akerlof 1982). Gift exchange is usually but erroneously associated with the giving and receiving of explicit gifts on occasions such as birthdays, anniversaries, holidays and other special personal moments but is more encompassing. However significant in economic terms (Economist 2006), gift exchange is not limited to gifts in that sense. A mixture of motives is involved in gift exchange, including altruism and self-interest (Malinowski 1996; Mauss 1954; Blau 1964; Ekeh 1974). Smart (1993) points out that the exchange partners need not be unaware of the instrumental goals involved. Both the possibly instrumental goals involved as well as the perceived value of a gift must be ignored (cf. Bourdieu 1993, Beltramini 1996). If actors fall short of these expectations, the particular dyadic exchange relationship may be terminated and excommunication from the wider social relational network may follow (Van der Eijk et al. 2006). As Williamson (1975:

p.107) states: “Individual aggressiveness is curbed by the prospect of ostracism among peers, in both trade and social circumstances”.

Mauss (1954) has indicated that people are required to (1) give, (2) receive, and (3) reciprocate (cf. Dore 1983; Gouldner, 1960; Levi-Strauss, 1996; Malinowski, 1996; Sahlins, 1996; Schwartz, 1996; Simmel, 1996). Most resources can be gifts, as gifts may be defined as those goods, material or immaterial, including knowledge, feedback and tips, given to an alter in the expectation that it will be accepted and reciprocated. Gift exchange needs to be out-of-balance at any moment in time so that it is clear that a relation will continue in the future.

Because gift exchange is unbalanced when viewed at one point in time, a longitudinal perspective reveals the nature of gift giving: a gift is not reciprocated by an immediate return or compensation (Mauss 1954; Bourdieu 1977; Ferrary 2003.; Deckop et al. 2003). A deferred return obligates one individual to another, creating a social debt. Since reciprocity is open to discretion as to the value and form of the counter gift the nature of the compensation is not specified before hand (Bourdieu 1977; Gouldner 1960; Mauss 1954; Deckop et al. 2003). Gift exchange is carried out without a legal contract (Ferrary 2003), but even so it creates an informal non strict obligation to reciprocate (Gouldner 1960; Levi-Strauss 1996; Malinowski 1996; Mauss 1954; Sahlins 1996; Schwartz 1996; Simmel 1996). Gift giving thus confers benefits of an economic and a social nature simultaneously (Belk 1979; Larsen & Watson 2001). Gift exchange is, thus, not only an economic transaction providing economic (material) benefit, it is also a good in itself, a ‘process benefit’, in the sense of sustaining personal relationships (Avner 1997). Personal relations between giver and receiver are an important dimension of many transactions and have a value independent of their instrumental functions in regulating transactions (Rose-Ackerman 1998). The notion of gift exchange thus explains how relations are established, maintained, or may discontinue (Larsen & Watson 2001; Belk 1979; Gouldner, 1960; Cheal 1988; Mauss, 1954; Ruth et al., 1999; Sherry, 1983; McGrath et al., 1996).

As a corollary of the cycle of giving and reciprocating of a resource unspecified, diffuse, future **obligations**, as well as **trust** and **gratitude** are generated between the (exchange) parties involved (Sahlins 1996; Mauss 1954; Gouldner 1960; Euhara 1990; Blau 1964; Belk and Coon 1993). Gift exchange is thus associated with the generation of positive emotions and uncertainty reduction which generates cohesion and commitment (Lawler et al. 2000; Homans 1958; Ingram & Robert, 2000). Frequent gift or favor exchange is associated with the creation of trust facilitating further cooperation (Coleman, 1988; Fukuyama, 1995; Putnam, 1993; Nooteboom, 2002). Gifts exchange establishes a common frame of reference, lowering associated risk and uncertainty between parties, and establishes partners’ trustworthiness (McAllister, 1995; Shapiro, 1987; Smith Ring and van de Ven, 1992; van der Eijk et al. 2006). This process allows partners to infer both competence and intentional trust in alter (Nooteboom, 2002). What may have started out as a purely goal oriented interaction may become embedded overtime in social relations (Granovetter 1985),

in part because individuals strive to derive a sense of pleasure or intrinsic satisfaction from their interactions (Eccles 1981).

"Gifts can be described as an investment in the relationship between donor and recipient. The greater the value of the gift, the more substantial the investment" (Larsen & Watson; 2001). These investments are not only necessary since connections are not givens but require work (Bourdieu 1977, 1986), but also expedient since they can be used to (try to) create social obligations (Burt 1992; Coleman, 1988, 1994; Granovetter, 1985; Mauss, 1954; Darr 2003; Bourdieu 1977; Walton & Mckersie 1969; Kotter 1985; Yukl & Falbe 1991). By the same token, if others are indebted to the focal actor the focal actor can use this as a basis for future influence and an entitlement to future support (Coleman 1988, 1994; Mauss 1954). Given that these future obligations are social, non-contractual and legally unenforceable, actors cannot draw on them at will. Failing to reciprocate will effectively prevent future profitable exchanges but also mean excommunication from the relevant group (Ferrary 2003; Van der Eijk et al. 2006; Barney & Hansen 1994 from Rose-Ackerman 1998; Williamson 1975). The literature on gift exchange is rightly placed in the broader context of social exchange theory (Ekeh 1974), and so the explanation we offer to explain knowledge transfer in an open innovation context is, we believe complementary to explanations offered by others (von Hippel 1987, Lakhani & von Hippel 2003).

Exchanges of gifts, since they not only transfer utility but are also socially meaningful interactions embedded in relations of mutual dependence and obligation, then contribute to the willingness to transfer knowledge (Cheal 1986; Camarer 1988). This is evident from the discussion of how corporate scientists share knowledge.

4.6 Gifts, Knowledge, and Corporate Scientists

Considering the uncertainty, asymmetry and social dimensions related to knowledge, market contracts or direction in a hierarchy is not likely to work. In the context of the development of open source software, this already is readily acknowledged (Henkel 2006; von Hippel 1987; Lakhani & von Hippel 2003). In this section we argue that the mechanism we have elaborated play a role in other sectors and environments as well.[31] Gift exchange, not necessarily fully voluntary, is driven by obligations of a social and informal nature (Dolfsma & Van der Eijk 2008). Gift exchange, involving altruistic as well as more self-interested motives, as explained above, provides the parties involved with a mechanism for the exchange of resources and an incentive to so. Social obligations stemming from gift exchange and the network position taken can be employed to try to elicit future support (Coleman, 1988) for instance to acquire the knowledge needed for (future) projects (cf. Avner 1997; Blau 1964; Bourdieu 1977, 1986; Humphrey & Hugh-Jones 1992; Darr 2003).

Reciprocal gift exchange establishes a transactional relationship between individuals (Sherry, 1983) and allows actors to forge and personalize relationships and to develop guarantees of personal bonding (Zucker 1986; Shapiro 1987). As these relationships develop and the

31 Compare the account in The Economist (2004): "An open-source shot in the arm?" (June 12), pp.15-17.

exchange interactions progress actors learn to cooperate with these particular others (Powell et al., 1996, Starpoli, 1998; Galuti, 1995) and establish a common frame of reference allowing actors to incorporate new (tacit) knowledge (Hansen, 1999; Kogut & Zander, 1992; Von Hippel, 1994). As actors thus bridge 'cognitive distance' (Nooteboom, 2002) "tacit or personal knowledge which is anchored on the commitment of and beliefs of its holder" (Nonaka, 1994) can be interpreted and acted upon.

In studies looking at what determines the success that some corporate scientists have and others lack some noteworthy findings emerge. Those who actively engage in the publication of papers, giving to the scientific community at large, are more successful than those who don't. This is, obviously, partly due to the fact that this is a means for them to be up-to-speed with the most recent developments in their fields, keeping their own and their organization's absorptive capacity high (Cohen & Levinthal, 1989). There is more to this, however. These scientists claim themselves that they also receive more from others, working elsewhere, formally and informally, in the form of access to scientists in other organizations and unpublished tacit knowledge (Furukawa & Goto, 2006; Hicks, 1995). Most of the knowledge at the frontier of advanced research may be tacit (Hicks 1995); such knowledge can be shared with researchers whom one has established a longer term relationship of trust and understanding with, a relationship of strong ties (Hansen 1999). This active behavior in publishing of some scientists in an organization boosts their effectiveness within their own organizations as well. The resulting flow of knowledge encourages innovation in which they themselves and their co-workers are involved, thereby benefiting the organization as whole (Furukawa & Goto, 2006). Corporate scientists, creating goodwill and establishing obligations 'by building a relationship of give and take with the scientific community' (Hicks 1995), can act as technological gatekeepers and serve as a bridge between external sources of knowledge and their co-workers.

The story of successful corporate scientists cooperating informally through gift exchange continues. Bouty (2000) has shown that they are involved in relations with scientists they know in other, sometimes competing, organizations helping each other out in ways that may counter explicit organizational regulations, and if taken advantage off could seriously hurt the organization. Still, for specific others, laboratory tests, feed back, hints and the like are exchanged. The gift element is clear: if a person is not known, no gifts are exchanged; if a person is not known well, gifts of low value such as commonly available knowledge is exchanged; if a person is known well and for a long time very valuable knowledge can be exchanged. In each of these cases, of course, no guarantee of a counter-gift, of equal value, is available. Opportunism remains possible at all times, but would lead to excommunication and a loss of reputation. These relations between corporate scientists within and between firms is not an unknown observation (see Allen 1977; Kreiner & Schultz 1993; Von Hippel 1987; or the communities-of-practice literature Wenger & Snyder 2000; Wenger 1998; Brown & Duguid 1991, 2001), but tends not to be conceptualized in terms of gift exchange.

4.7 Limitations to Gift Exchange

While gift exchange can provide a stimulus for the flow of knowledge, its ability to coordinate and provide an incentive for knowledge exchange does have limitations. Firstly, gift exchange for the most part takes place between concrete individuals and may be hard to formulate formal policy for. Secondly, for gift exchange to personalize relations and develop guarantees of personal bonding is inevitably constrained by time. One is only able to initiate and maintain so many relationships in a given period of time (Lesser 2000). Thirdly, social obligations established through gift exchange cannot be enforced and so actors are most likely to coordinate knowledge exchange via gift exchange when other options are not sufficient, too inflexible, too time-consuming or otherwise impractical (Ferrary, 2003; Smart 1993). Fourthly, gift exchange effectiveness in part depends on the extend to which the incentive structure of an organization can be altered in such a way that honoring social debts and cooperation becomes an effective course of action for the individual. The effectiveness of social enforcement mechanisms can be impaired if the likelihood or benefit of continued cooperation is small (Kreps, 1990), the network structure is such that action cannot be monitored or communicated limiting the effectiveness of reputations (Hill, 1990; Lazaric & Lorenz, 1998; Coleman, 1988), or hostages are unavailability or incredibility (Williamson, 1985; Nooteboom, 2002). Finally, while organizations generally strive to maximize knowledge flows within organizational boundaries they are likely to endeavor to minimize knowledge flows across organizational boundaries. While spillover effects are pervasive (Feldman 1999; Audretsch & Feldman 1996; Jaffe et al. 1993; Marshall 1920; Krugman 1991; de Laat 1999; Owen-Smith & Powell 2004), they are not only associated with formal cooperative arrangements between firms but also with informal personalized exchange between knowledge workers (e.g. Allen, 1977; Kreiner & Schultz, 1993; Von Hippel, 1987; Agrawal et al., 2003). While, it is evident that companies need to preserve core competencies (cf. Henkel 2006), there is a danger that organizations attach to much weight to appropriability, while neglecting the dynamic of new knowledge creation and knowledge flows between firms and other social entities that they may also benefit from in the end (Chesborough 2003; Nooteboom 2002; von Hippel 1987; Saxenian 1994). As a result, too strict a policy of spill-over control might hamper the innovation development process since those who do not give, do not receive in return. Nonetheless, in gift exchange actors evaluate the value of knowledge exchanged, especially when crossing organizational boundaries, affecting the kind and scope of knowledge likely to be exchanged via gifts (von Hippel 1987; Kreiner & Schultz 1993; Bouty 2000).

4.8 Conclusion

Firm innovativeness is largely dependent on people within (and beyond) the firm exchanging knowledge and information. Therefore, the contacts that people have play an important role for the firm. Social Network Analysis (SNA) allows an analysis of the structure of interactions within a firm: how do interactions affect behavior of actors within a firm and ultimately firm performance? Given the nature of knowledge and its development, discussed

in section 2 above, however, the issue of why actors would actually use their relations for these purposes and if they actually could do so remains a mystery for SNA. SNA has an 'action problem' as it does not allow for agency.

We suggest that the notion of gift exchange allows one to explain why persons exchange knowledge with each other even if they are not obliged to by contract or instruction. Gifts can be non-material to include knowledge and are exchanged for multiple reasons. Gift exchange creates mutual trust as well as informal obligations between persons, and allows one to understand how relations start, work and end. In this article we have argued how gift exchange offers a powerful and necessary complement to the insights that Social Network Analysis offers. In addition, we have shown how researchers involved in gift exchange are more successful as researchers. Managers of firms may thus be consoled when they allow their team members to selectively exchange knowledge with others close to them even if that means that knowledge may spill over. In fact, and especially when the aim is to stimulate knowledge transfer within the firm, possibly across department boundaries, managers may be well advised to purposefully start the process of giving knowledge. Being in a central (powerful) position, they may expect to receive more than they have given, as the well-known Matthew effect in gift exchange behavior takes hold (Merton 1968). Most immediately, however, we offer participants a perspective for understanding the way in which informal, but also formal relations take shape and how they may or may not contribute to knowledge transfer. Thus we offer a perspective for the discussion on 'open innovation' that complements the more strategic discussions of the micro processes of socially sharing knowledge within and between organisations.

References

Abreu, D. (1988) 'On the Theory of Infinitely Repeated Games with Discounting.', *Econometrica*, 56(2), 383-396

Adams, J.S. (1965) 'Inequity in social exchange,' *In: Advances in experimental social psychology.,* Ed. Berkowitz, L., New York: Academic Press.

Adler, P.S. (2001) 'Market, Hierarchy, and Trust : The Knowledge Economy, and the Future of Capitalism' Organization Science 12(2): 215-234.

Adler, P.S., & Kwon, S.W. (2002) 'Social capital' *Academy of Management Review* 27(1): 17-40

Agrawal, A.K., Cockburn, I.M., & McHale, J. (2003) 'Gone but not forgotten : Labor flows, knowledge spillovers and enduring social capital.'*Working Paper 9950*

Ahuja, G. (2000), 'Collaboration Networks, Structural Holes, and Innovation' *Administrative Science Quarterly* 45: 425-455.

Akerlof, G.A. (1982) 'Labor Contracts as Partial Gift Exchange' *Quarterly Journal of Economics* 97: 543-569.

Allen, T.J. (1977) *Managing the flow of technology.* Cambridge MA: The MIT Press.

Allen, T.J., & Cohen, S.I. (1969) 'Information flow in research and development laboratories' *Administrative* Science Quarterly 14: 12-19.

Amabile, T.M. (1988) 'A model of creativity and innovation in organizations' *Research in Organizational Behavior* 10: 123-167.

Arrow, K.J. (1984) 'Information and economic behavior', *In: Collected Papers of Kenneth J.Arrow*, Vol.4., Belknap Press, Cambridge, MA.

----, (1971) Essays in the Theory of Risk Bearing. Markham, Chicago, IL.

Audretsch, D.B. & Feldman, M. (1996) "R&D spillovers and geography of innovation and production"

American Economic Review 86(3), 630-640

Autio, E., Hameri, A. & Vuola, O. (2004) 'A framework of industrial knowledge spillovers in big-science centers' Research Policy 33: 107-126.

Axelrod, R. (1984) *The Evolution of Cooperation*, New York: Basic Books

Avner, O. (1997) 'Between the Gift and the Market' *Economic History Review* 50(3): 450-476.

Belk, R. (1979) 'Gift-Giving behavior', In: *Research in Marketing Volume 2*, Ed. Sheth, J., Greenwich, CT:, JAI Press

Belk, R.W., & Coon, G.S. (1993) "Gift Giving as Agapic Love" *Journal of Consumer Research* 20: 393-417.

Beltramini, R.F. (1996) 'Business believes in Gift Giving', In: *Gift Giving: A Research Anthology*, Ed. Otnes, C. & Beltramini, R.F., Bowling Green: Bowling Green State University Press

Berger, P. L., & Luckman, T. (1967) The social construction of reality. Garden City, NY: Anchor.

Blau, P. (1964) Exchange and Power in Social Life. New York: Wiley

Bourdieu, P. (1986), 'Forms of Capital', In: Handbook of Theory and Research for the Sociology of Education., Ed. Richardson, J. G. , New York: Greenwood Press.

----, (1977) *Outline of a Theory in Practice.* Cambridge UP: Cambridge

Bouty, I. (2000) 'Interpersonal and interaction influences on informal resource exchanges between R&D researchers accros organizational boundaries' *Academy of Management Journal* 43(1): 50-65

Bradach, J.L. & Eccles, R.G. (1989) 'Market versus Hierarchies' in R. Th. A.J. Leenders and S.M. Gabbay (eds), Corporate Social Capital and Liability, Dordrecht: Kluwer, pp.97-118

Brown, J.S. & Duguid, P. (1991), 'Organizational Learning and Communities of Practice' *Organization Science* 2(1): 40-57

----, (2001) 'Knowledge and Organization' *Organization Science* 12(2): 198-213.

Burt, R.S. (1992) Structural holes: The social structure of competition. Cambridge, MA: Harvard UP.

----, (2004) 'Structural Holes and Good Ideas' *American Journal of Sociology* 110: 442-455

Camerer, C. (1988) 'Gifts as Economic Signals and Social Symbols' *American Journal of Sociology* 94: 180-214

Charles, K.K., & Kline, P (2002) 'Relational cost and the reproduction of social capital' *Working papers* series (9041)

Cheal, D. (1986) 'The Social Dimensions of Gift Behaviour' *Journal of Social and Personal Relationships* 3:

423-439
Chesbrough, H. (2003a) *Open Innovation.* Harvard Business School Press.
----, (2003b) "The Logic of Open Innovation: Managing Intellectual Property" *California Management Review* 45(3): 33-58
Cohen, W.M., & Levinthal, D.A. (1989) 'Innovation and learning: The two faces of R&D' *Economic Journal* 569-596
Cohen, W.M., & Levinthal, D.A. (1990) 'Absorptive capacity' *Administrative Science Quarterly* 35: 128-152.
Coleman, J.S. (1994) *Foundations of Social Theory.* Cambridge MA: Belknap Press.
----, (1988) 'Social Capital in the creation of Human Capital' *American Journal of Sociology* 94 (Suppl.): S95-S120.
Coleman, J.S., Katz, E., & Menzel, H. (1966) *Medical Innovations.* Indianapolis: Bobbs-Merrill.
Cross, R. & Prusak, L. (2002), 'The People Who Make organizations Go- or Stop' *Harvard Business Review* 80(6):104-112.
Cross, R., Parker, A., & Borgatti, S. (2001),'Knowing what we know: Supporting knowledge creation and sharing in social networks' *Organizational Dynamics* 30(2): 100-120
Darr, A. (2003), 'Gifting Practices and Inter-organizational Relations' *Sociological Forum* 18(1): 31-51.
Darr, E.D., Argote, L., & Epple, D. (1995) "The Acquisition, Transfer, and Depreciation of Knowledge in Service Organizations" *Management Science* 41(11): 1750-1762.
Davenport, T.H. (1997) 'Ten principles of knowledge management and four case studies', *Knowledge and Process Management,* 4(3), 187-208
----, (1998) Working Knowledge: How Organizations Manage What They Know. Cambridge, MA: Harvard Business School Press.
Decarolis, D.M., & Deeds, D.L. (1999) "The Impact of Stocks and Flows of Organizational Knowledge on
Firm Performance" *Strategic Management Journal* 20(10): 953-968.
Deckop, J.R., Cirka, C.C., & Andersson, L.M. (2003) 'Doing Unto Others: The Reciprocity of Helping Behavior in Organizations' Journal of Business Ethics 47: 101-113
Dolfsma, W. (2008) *Knowledge Economies*. London: Routledge.
----, (2008b) "Making Knowledge Work" *Knowledge Organization* 35, forthcoming.
Dolfsma, W. & R. van der Eijk (2008) "Knowledge Development and Coordination via Market, Hierarchy and Gift Exchange" in: J.B. Davis (ed.) *Social Economics*. London: Routledge.
Dore, R. (1983) "Goodwill and the spirit of market capitalism" *British Journal of Sociology* 34(4): 459-482.
Dosi, G. (1982) "Technologial Paradigms and Technological Trajectories" *Research Policy* 11: 147-162.
Eccles, R.G. (1981), 'The quasifirm in the construction industry' *Journal of Economic Behavior & Organization* 2(4): 335-357.
Economist (2006) *The business of giving*. February 25.
Eijk, R. van der, W. Dolfsma and A. Jolink (2006) No Black Box and No Black Hole: from Social Capital to Gift Exchange. Mimeo.
Ekeh, P.P. (1974) Social Exchange Theory: the two traditions. London: Heinemann.
Emerson, R.M. (1981), 'Social Exchange Theory', *In: Social Psychology: Sociological Perspective*, Eds. Rosenberg, M. & Turner, R., New York: Basic Books
Feldman, M.P. (1999) 'The new economics of innovation, spillovers and agglomeration' *Economics Innovation &* New Technology 8: 5-25.
Ferrary, M. (2003) 'The Gift Exchange in the Social Networks of Silicon Valley' *California Management Review* 45(4), 120-138.
Field, J. (2003) *Social Capital.* London and New York: Routledge
Fine, B. (2000) *Social Capital versus Social Theory.* London and New York: Routledge.
Flynn, F.J. (2003) "How much should I give and how often? Th effects of generosity and frequency of favor exchange on social status and productivity" *Academy of Management Journal* 46(5): 539-553.

Freeman, C. (1991) “Networks of innovators” *Research Policy* 20: 499-514.
Frenzen, J.K. & Davis, H.L. (1990) ’Purchasing Behavior in Embedded Markets’ *Journal of Consumer Research* 17(1): 1-12.
Fudenberg, D., & Maskin, E. (1986) ‘The Folk Theorem in Repeated Games with Discounting or with Incomplete Information’ *Econometrica* 54(3): 533-554.
Fukuyama, F. (1997) Social capital and the modern capitalist economy. Stern Business.
---, (1995) Trust, the Social Virtues and the Creation of Prosperity. New York: Free Press.
Furukawa, R. & Goto, A. (2006) “The role of corporate scientists in innovation” *Research Policy* 35: 24-36.
Gabbay, S.M., & Zuckerman, E.W. (1998) ‘Social capital and opportunity in corporate R&D’ *Social Science Research* 27(2): 189-217.
Galunic, C., & Moran, P. (2000) ‘Social capital and productive exchange’ *Working Paper Insead* 1: 1-31.
Ghoshal, S. & Bartlett, C.A. (1988) ‘Creation, adoption, and diffusion of innovations by subsidiaries of multinational corporations’, *Journal of International Business Studies* 19: 365-388.
Gouldner, A.W. (1960) “The Norm of Reciprocity” *American Sociological Review* 25: 161-178.
Granovetter, M.S. (1973) ‘The Strength of Weak Ties’ *American Journal of Sociology* 78, 1360-1380.
----, (1985) “Economic Action and Social Structure” *American Journal of Sociology* 91(Nov): 481-510.
Gulati, R. (1995) “Does familiarity breed trust” *Academy of Management Journal* 38: 85-112.
Gulati, R. & Lawrence, P. (1998) ‘The architecture of cooperation’ *Administrative Science Quarterly* 43: 781-814.
Hansen, M.T. (2002), ‘Knowledge networks: Explaining effective knowledge sharing in multiunit companies’, Organization Science 13(3): 232-248.
----, (1999) “The Search-Transfer Problem” *Administrative Science Quarterly* 44(1): 82-111.
Hardin, G. (1968) ‘ The Tragedy of the Commons’, *Science* 162: 1243-48.
Heath, A.F. (1976) Rational Choice and Social Exchange. Cambridge UP.
Heide, J.B. & Miner, A.S. (1992) ‘The shadow of the future: Effects of anticipated interaction and frequency of contact on buyer-seller cooperation’ *Academy of Management Review* 35: 265-291.
Henkel, J. (2006) “Selective revealing in open innovation processes: The case of embedded Linux” Research Policy 33: 953-969.
Hill, C.W.L. (1990), Cooperation, opportunism and the invisible hand” *Academy of Management Review* 15(3): 500-513
Hodgson, G.M. (2005) ‘Knowledge at Work’ *Review of Social Economy* 60(4): 547-65.
Homans, G.C. (1974), *Social Behavior.* New York: Harcourt Brace Jovanoviech.
----, (1958), ‘Social Behavior as Exchange’ *American Journal of Sociology* 63: 597-606.
Humphrey, C & Hugh-Jones, S. (1992), *Barter, Exchange and Value*, Cambridge, UK Cambridge UP.
Huysman, M. & de Wit, D. (2004) ‘Practices of Managing Knowledge Sharing” *Knowledge and Process Management* 11(2): 81-92.
Ingram, P. & Roberts, P. (2000) ‘Friendship among Competitors in the Sydney Hotel Industry’ *American Journal of Sociology* 106(2): 387-423.
Inkpen, A.C. (1996) ‘Creating Knowledge through Collaboration’ *California Management Review* 39(1): 123-140
Jaffe, A., Trajtenberg, M., & Henderson, R. (1993) “Geographic localization of knowledge spillovers, as evidenced by patent citations” *Quarterly Journal of Economics* 108: 863-911
Jones, C., Hesterly, W.S., & Borgatti, S.P. (1997) ‘A general theory of network governance: Exchange conditions and social mechanisms’ *Academy of Management Review* 22(4): 911-945.
Kim, W.C., & Mauborgne, R. (1998) ‘Procedural Justice, Strategic Decision Making, and the Knowledge Economy’ Strategic Management Journal 19(4): 323-338
Knight, K.E. (1967) ‘A Descriptive Model of the Intra-Firm Innovation Process’ *Journal of Business* 40(4): 478-496.
Knoke, D., & Kuklinski, J.H. (1982) *Network Analyses,* Newbury Park, CA : Sage.
Kogut, B., & Zander, U. (1992) ‘Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology’ *Management of Technology* 3(2): 383-397.

Komter, A.E. (1996) *The Gift: An Interdisciplinary Approach*. Amsterdam: Amsterdam UP.
Kotter, J. (1985) *Power and Influence.* Free Press, New York
Kreiner, K., & Schultz, M. (1993) "Informal Collaboration in R&D." *Organization Studies* 14(2): 189-209
Kreps, D., Milgrom, P., & Wilson, R. (1982) 'Rational Cooperation in the Finitely Repeated Prisoner's Dilemma', Journal of Economic Theory, 27, 245-252
Kreps, D.M. (1990) 'Corporate culture and economic theory', In: *Perspectives on Political Economy*, Eds. Alt, J & Shepsel, K., University Press Cambridge
Krugman, P. (1991) 'Increasing returns and economic geography' *Journal of Political Economy* 31: 483-499
Laat, P.B. de (1999) 'Dangerous liaisons: Sharing knowledge within R&D alliances', In: Interfirm Networks, Organizations and Industrial Competitiveness, Eds Grandori, A., London: Routledge
Lakhani, K.R. and E. Von Hippel (2003) "How open source software works: 'free' user-to-user assistance" *Research Policy* 32: 923-943.
Landry, R., Amara, N., & Lamari, M. (2002) 'Does social capital determine innovation? To what extent?' Technological Forecasting and Social Change 69: 681-701.
Larsen, D. & Watson, J.J. (2001) 'A Guide Map to the Terrain of Gift Value' *Psychology & Marketing*, 18(8), 889-906
Laursen, K. and N.J. Foss (2003) "New human resource management practices, complementarities and the impact on innovation performance" *Cambridge Journal of Economics* 27: 243-263.
Lave, J.C. & Wenger, E. (1991) *Situated Learning.* New York: Cambridge UP.
Lawler, E., Thye, S., & Yoon, J. (2000) 'Emotion and group cohesion in productive exchange' *American Journal of Sociology* 106: 616-657.
Lazaric, N. & Lorenz, E. (1988), 'Corporate Social Capital', *In: Corporate Social Capital and Liability*, Eds. R.Th.A.J. Leenders & S.M. Gabbay, Dordrecht: Kluwer: 1-14.
Lesser, E.L. (ed) (2000), *Knowledge and Social Capital.* Butterworth Heinemann: Boston.
Lesser, E., & Prusak, L. (1999) "Communities of Practice, Social Capital and Organizational Knowledge" Information Systems Review 1(1): 3-9.
Levi-Strauss, C (1996) 'The principle of reciprocity', In: *The Gift: An Interdisciplinary Perspective,* Ed. Komter, A.E. , Amsterdam: Amsterdam UP.
Lopes, H. and J. Castro Caldas (2008) "Firms: collective action and its supportive values" in: W. Dolfsma & J. Davis (eds) Elgar Companion to Social Economics. Cheltenham: Edward Elgar.
Marshall, A (1920) *Principles of Economics.* 7th edition. Macmillan, London
McAllister, D.J. (1995) 'Affect- and cognition based trust as foundations for interpersonal cooperation in organizations' Academy of Management Journal 23: 262-288
McGrath, M.A. & Englis, B. (1996) 'Intergenerational Gift Giving in Sub-cultural Wedding Celebrations', In: *Gift Giving: A Research Anthology*. Ed. Otnes, C. & Beltramini, R.F., Bowling Green: Bowling Green State UP.
Maitland, I. (2002), 'The Human Face of Self-Interest' *Journal of Business Ethics*, 38, 3-17
Malinowski, B. (1996) 'The Principle of Give and Take' In: *The Gift: An Interdisciplinary Perspective,* Ed. Komter, A.E., Amsterdam: Amsterdam University Press
Markides, C., & Williamson, P. (1994) 'Related diversification, core competencies and corporate performance', Strategic Management Journal 15: 149-167.
Mauss, M. (1954) [2000], *The Gift.* New York: Norton.
Merton, R.K. (1965) *On The Shoulders of Giants.* Free Press.
----, (1968) "The Matthew Effect in Science" Science 159: 56 - 63
Mokyr, J. (2002) The Gifts of Athena – Historical Origins of the Knowledge Economy. Princeton, NJ: Princeton UP.
Moran, P (2005) "Structural versus relational embeddedness" *Strategic Management Journal* 26: 1129-1151
Moran, P., & Ghosal, S. (1996) 'Value creation by firms', *Academy of Management Proceedings,* 35-39
Nahapiet, J., & Ghosal, S. (1998) 'Social capital, intellectual capital, and the organizational advantage', *Academy*

of Management Review, 23(20), 242-266
Nelson, R.R. (1959) "The simple economics of basic scientific research" *Journal of Political Economy* 57: 297-306.
Nonaka, I. (1994) 'A Dynamic Theory of Organizational Knowledge Creation' *Organization Science* 5(1): 14-37.
Nonaka, I., & Takeuchi, H. (1995) *The Knowledge-Creating Company.* New York: Oxford UP.
Nooteboom, B. (2002) *Trust.* Cheltenham: Edward Elgar.
Obstfeld, D. (2005), ' Social Networks the Tertius Lungens Orientation, and Involvement in Innovation', Administrative Science Quarterly, 50, 100-130.
Olson, M. (1965) *The Logic of Collection Action.* Cambridge, MA: Harvard UP.
Ostrom, E. & Ahn, T. K. (2003) *Foundations of Social Capital*, Northhampton: Edward Elgar.
Ouchi, W.G. (1980) 'Markets, bureaucracies, and clans' *Administrative Science Quarterly* 25 (1): 129-141
Owen-Smith, J., & Powell, W.W. (2004) 'Knowledge Networks as Channels and Conduits' *Organization Science* 15 (1): 5-21
Park, S.O. (2002) 'Regional innovation strategies in the knowledge-based economy' *GeoJournal* 53(1): 29-38
Parkhe, A. (1993) 'Strategic alliance structuring' *Academy of Management Journal* 36: 794-829
Perry-Smith, J.E. & Shalley, C.E. (2003) 'The social side of creativity' *Academy of Management Review* 28(1): 89-106.
Podolny, J.M. (2001) 'Networks as the Pipes and Prisms of the Market' *American Journal of Sociology* 107(1): 33- 60.
I. van de Poel, M. Fransen and W. Dolfsma (2002) "Technological Regimes" *International Journal of Technology,* Policy and Management 2(4): 482-495.
Polanyi, M. (1966) *The Tacit Dimension,* New York: Anchor Day Books
Portes, A. & Sensenbrenner, J. (1993) 'Embeddedness and immigration: notes on the social determinants of economic action' American Journal of Sociology 98, 1320-1350.
Portes, A. (1998), 'A Social Capital: its origins and applications in modern sociology', In: *Knowledge and Social Capital.* E. L Lesser (ed.). Butterworth Heinemann: Boston.
Powell, W.W. (1996) 'Inter-organizational collaboration in the biotechnology industry' *Journal of Institutional* Theoretical Economy 152: 197-215.
Powell, W.W., Koput, K.K., & Smith-Doerr, L. (1996) 'Inter-organizational collaboration and the locus of innovation' Administrative Science Quarterly 41: 116-145.
Powell, W.W., Koput, K.W., Bowie, J.I. & Smith-Doerr, L. (2002) 'The Spatial Clustering of Science and Capital'
Regional Studies 36 (3): 291-305.
Putnam, R.D. (2000) *Bowling Alone.* New York: Simon and Schuster
----, (1995) 'Bowling Alone: America's declining social capital' *Journal of Democracy* 6: 65-78.
----, (1993) *Making Democracy Work.* Princeton, NJ: Princeton UP.
Reagans, R. & McEvily, B. (2003) 'Network Structure and Knowledge Transfer' *Organization Science* 13(3): 232-248
Rogers, E.M. (1995) *Diffusion of Innovations,* New York: Free Press.
Romer, P. (1992) "When should we use intellectual property rights", *Monthly Review*, 54(8), 29-37.
Rose-Ackerman, S. (1998) 'Bribes and Gifts', *In: Economics, values and organization,* Eds. Ben-ner, A & Putterman, L., Cambridge UP.
Rowley, T., Behrens, D., & Krackhart, D. (2000) " Redundant governance structures" *Strategic Management Journal* 21, 369-386.
Ruth, J.A., Otnes, C.C., & Brunel, F.F. (1999) 'Gift receipt and the reformulation of interpersonal Relationships', Journal of Consumer Research 25(4): 385-402
Sahlins, M, D. (1996), 'On the Sociology of Primitive Exchange", *In: The Gift: An Interdisciplinary Perspective*, Ed. Komter, A.E., Amsterdam: Amsterdam UP.
Schumpeter, J. (1934 [1978]) *The Theory of Economic Development.* London; Oxford UP.
Schwartz, B. (1996) 'The Social Psychology of the Gift', *In: The Gift: An Interdisciplinary Perspective,* Ed.

Komter, A.E., Amsterdam: Amsterdam University Press.
Scotchmer, S. (1991) "Standing on the Shoulders of Giants: Cumulative Research and the Patent Law" *Journal of* Economic Perspectives 5(1): 29-41.
Scott, J. (1991) *Social network analyses.* London: Sage.
Shapiro, S.P. (1987) 'The social control of impersonal trust' *American Journal of Sociology*, 93: 623-658
Shapiro, C. & Varian, H.R. (1999) *Information Rules.* Harvard Business School Press: Boston Massachusetts.
Sherry, J.F. (1983), 'Gift Giving in Anthropological Perspective' *The Journal of Consumer Research,* 10(2), 157-168.
Simmel, G. (1996) 'Faithfulness and Gratitude', In: *The Gift: An Interdisciplinary Perspective*, Ed. Komter, A.E., Amsterdam: Amsterdam UP.
Simon, A. (1991), 'Bounded rationality and organizational learning', *Organization Science*, 2, 125-134.
Sjostrand, G. (2004), 'The modern gift institution in industrial districts', *Economic Sociology*, 5(3).
Skvoretz, J. & Lovaglia, M.J. (1995) 'Who Exchanges with Whom' *Social Psychology Quarterly* 58: 163-177.
Smart, A. (1993) 'Gifts, Bribes, and Guanxi' *Cultural Anthropology* 8(3): 388-408.
Smith-Doer, L., Owen-Smith, J.O., Kogut, K.W. & Powell, W.W. (1999) 'Networks and knowledge production', *In: Corporate Social Capital and Liability*, Eds. R.Th.A.J. Leenders & Gabbay, S.M.
Smith Ring, P. & van de Ven, A. (1992) 'Structuring cooperative relationships between organizations' *Strategic* Management Journal 13: 483-498.
Starpoli, C. (1998) 'Cooperation in R&D in the pharmaceutical industry' *Technovation* 18(1): 13-23.
Szulanski, G. (1996) 'Exploring internal stickiness' *Strategic Management* 17: 27-43.
Telser, L.G. (1980) 'A theory of self-enforcing agreements' *Journal of Business* 53: 27-44
Tidd, J., Bessant, J., & Pavitt, K. (2001) *Managing Innovation.* Chichester: Willey & Sons
Tsai, W. & Ghosal, S. (1998) 'Social Capital and Value Creation' *Academy of Management Journal* 41(4): 464-476
Tsai, W. (2001), 'Knowledge transfer in intra-organizational networks' *Academy of Management Review* 44: 996-1004
Tushman, M.L. & Scanlan, T.J. (1981) "Boundary spanning individuals" *Academy of Management Journal* 24: 289-305.
Tushman, M.L. (1977) 'Special boundary roles in the innovation process' *Administrative Science Quarterly* 22: 587-606.
Uehara, E. (1990), 'Dual Exchange Theory, Social Networks, and Informational Support', *The American Journal of Sociology*, 96, 521-557.
Uzzi, B. (1997), 'Social Structure and competition in inter firm networks' *Administrative Science Quarterly* 42(1): 35-67.
Von Hippel, E. (1999) "Economics of product development by users" *Management Science* 44(5): 629-644.
----, (1994) "'Sticky information' and the locus of problem solving" *Management Science* 40(4): 429-439.
----, (1987) 'Cooperation between rivals: Informal know-how trading' *Research Policy* 16: 291-302.
Walker, G., Kogut, B., & Shan, W. (1997) 'Social capital, structural holes and the formation of an industry network' Organization Science 8: 109-125.
Walster, E., Berscheid, E., & Walster, G.W. (1973) 'New Directions in Equity Research' *Journal of Personality* and Social Psychology, 25(2), 151-176.
Walton, R. & McKersie, R. (1969) *A Behavioral Theory of Labor Negotiations*, McGraw-Hill, New York.
Wasserman, S., & Faust, K. (1994) *Social Network Analysis.* Cambridge, England: Cambridge UP.
Weigelt, K. & Camerer, C. (1988) 'Reputation and corporate strategy' *Strategic Management Journal* 9: 443-454.
Wenger, E.C., & Snyder, W. (2000) 'Communities of Practice the Organizational Frontier' *Harvard Business Review*, 139-145.
Wenger, E.C. (1998) *Communities of Practice.* Cambridge: Cambridge UP.
Williams, B. (1988),'Formal structures and social reality', *In: Trust.* Ed. Gambetta, D., Oxford: Blackwell.
Williamson, O,E., (1985) *The Economic Institutions of Capitalism.* New York: The Free Press.

----, (1975) *Markets and Hierarchies.* New York: Free Press.
Winter, S.G. & Szulanski, G (2001), 'Replication as Strategy, *Organization Science* 12(6): 730-743.
Woodman, R.W., Sawyer, J.E., & Griffin, R.W. (1993) 'Toward a theory of organizational creativity' *Academy of* Management Review 18: 293-321.
Woolcock, M. (1998) " Social Capital and Economic Development" *Theory and Society* 27(2): 151-208.
Yukl, G., & Falbe, C.M. (1991), 'Influence tactics and objectives in upward, downward and lateral relations', Journal of Applied Psychology 76: 416-423.
Zeitlyn, D. (2003) "Gift economies in the development of open source software: anthropological reflections" *Research Policy* 32(7): 1287-1291.
Zucker, L.G. (1986) 'Production of trust: Institutional sources of economic structure, 1840-1920.' *Research in* Organizational Behavior 8: 53-111.

Chapter 5
Research Design

5.1. Introduction

The preceding chapters have considered both the importance of knowledge transfer (cf. Moran & Ghosal, 1996; Nahapiet & Ghosal, 1998; Tsai & Ghosal, 1998) as well as some of its difficulties (cf. Ghosal & Barlett 1988; Kogut & Zander 1992; Hansen 1999; Szulanski 1996; Cross et al. 2001; Winter & Szulanski 2001), in some detail. Within this context, we demonstrated that as R&D scientists work on their research projects, they activate their network to acquire resources and information (Allen, 1977; von Hippel, 1987; Kreiner & Schultz 1993; Bouty 2000). These informal exchanges play an important if not essential role in initiating and maintaining the flow of knowledge. As a complement to previous research that demonstrated the importance of flow of knowledge, we focus on network structure and the underlying exchange mechanism facilitating the exchange of knowledge. Given the state of the field, the first objective is to acquire a deeper insight into the micro processes of knowledge transfer between R&D scientists utilizing a qualitative research methodology. At the same time, the present study aims to provide additional insights by embedding its finding further via empirical evidence based on a quantitative research methodology. In order to utilize and combine the strengths of both research approaches this study employs a multi-method research design.

Although there are certainly differences between the two research approaches, both methods are essentially ways of collecting data about the world (King et al., 1994). And as such, the same underlying logic of inference guides both quantitative and qualitative research (e.g. King et al., 1994; Silverman, 1993). Given their value, albeit for different research purposes, researchers are not necessarily forced to choose between one or the other (Lee, 1999). Following Lee (1999), Cassel and Symon (1994), Yin (2003) we try to achieve the best of both worlds by combining the two strands of research. Qualitative methods are then used to explore the knowledge transfer and exchange process between scientists and its contextual factors. The use of qualitative methods notwithstanding, survey data and the associated quantitative methodology represent the principal part of this study, the use of which allows us to investigate relationships between relevant exchange, network and performance variables. Thus, considering Cassel and Symon's (1994) advice "to count the countable", this research opts for a blending of qualitative and quantitative elements (e.g. Lee, 1999; Yin, 2003; Silverman, 1993). The dominant-less dominant design seems most appropriate since as Lee (1999) points out this design is the most practical blending-model considering that: "The major advantage of the dominant-less dominant design is its utilization of the unique strengths of one research tradition while capitalizing on the selected attributes of the other".

Consistent with these matters, two research approaches were combined in the present study. First, an on-site field study in an R&D lab of a Dutch multinational was undertaken, which resulted in a 4 month study during which data was gathered by conducting 37 in-depth interviews. Apart from corroborating aspects which are traditionally highlighted in literature, we sought to gain a deeper understanding of knowledge exchange in an R&D context. Second, an electronic network questionnaire was developed and administered to 232 researchers and project managers. In addition to the first research setting access to another R&D lab was negotiated, enabling us to survey two R&D labs in two large Dutch multinational. Respondents were asked to fill out a network survey questionnaire allowing us to explore the hypothesized patterns from a network perspective. Results from the electronic network questionnaire were used to corroborate finding from our case study. The manner in which these studies tie together and the paragraphs in which they are further explained is summarized in Table 5-1.

Table 5-1 Research Method and Unit of Analysis

Research Method	Unit of analysis	Research Setting
Qualitative - Interviews	Scientist (individual)	R&D Lab
Quantititative - Network Survey	Scientist (individual)	R&D Lab

The next paragraph will present details on the research settings chosen for this study as well as provide an outline of the research methodologies, both qualitative and quantitative, used. We continue by reviewing research analysis and data. Finally, the last paragraph considers how these two empirical investigations relate to one another and addresses matters of validity and reliability.

5.2. Research Setting

This paragraph seeks to clarify this study's empirical operationalization. Within every research, and nowhere more so than in the empirical phase, where the conceptual model is confronted with social reality, a multitude of choices have to be made regarding a study's research design. Describing the methods and procedural decisions, needed to judge the initially posed research question(s) in light of (social) data (Segers, 1983), is important for it makes choices explicit which would otherwise remain implicit. Empirical operationalization, then, in essence focuses on the question how the empirical data needed in order to test the conceptual model will be gathered and measured (Segers, 1983). In the course of this paragraph we will review a number of subjects. In paragraph 5.2.1, the research setting providing the backdrop for data collection is introduced. Then investigating the data collection method, paragraphs 5.2.2.1 and 5.2.2.2 discus the choice for and operationalization of the qualitative method after which paragraphs 5.2.2.3 and 5.2.2.4 offers a similar approach for

the quantitative (survey) method.

5.2.1 Research Methodology

Data collection took place at two Dutch multinational with strong research and development capabilities within the food and nutrition sector. Access to the companies was negotiated via three senior corporate research and development (R&D) managers. These managers became the main sponsors of the study and arranged for the access into two of the companies' research and development laboratories.

Data was gathered in two companies[32] active within the food and nutrition sector. The sector represents an important industry and R&D cluster within in the Netherlands. Dutch multinationals such as Unilever, Friesland Foods, DSM, Campina and Cosun have strong R&D interests within the sector and shape avenues for future research. The greater Wageningen area, also dubbed Food Valley, clusters a great many companies (or up to 10.000 scientists) active within the food and nutrition R&D. Research is supported by a constellation of networks and private-public partnerships such as; Top Institute Pharma in Leiden, Wageningen Center for Food Science in Wageningen and the Center for Molecular Medicine in Eindhoven. Research in the food industry not only has a strong presence in the Dutch innovation system it also is closely linked with chemical, biotechnology and pharmaceutical R&D centers in the Netherlands (Leydesdorf & Dolfsma, 2008).

The first site for data collection was a international cooperative dairy company (*Company X*). The company, active throughout every stage of the dairy chain, is a mayor supplier of consumer products such as milk, yoghurts and desserts, cheese and butter products, ingredients for the foodstuff and pharmaceutical industries. In 2007, at the time of data collection, the company employed some 6300 employees and had annual sales of 3.6 billion euros. The company consists of three fairly autonomous business groups that have operations in North America, Europe and Asia. The organizational structure is a typical multi-unit group in which each unit deals with distinct businesses and are responsible for product development, manufacturing and sales. In order to achieve growth in a highly competitive market the company emphasizes innovation[33] as a major driver for growth. Aiming to further strengthen its innovation output, the company has concentrated its research and development activities in three innovation centers. The study was conducted in one of the company's three innovation centers which focusses on the development of new, healthy and innovative consumer products. The research center fosters and maintains strong links with global external technology centers and universities. Following a recent centralization of R&D activities in a new innovation centre there was an interest in ascertaining the extent to which knowledge sharing took place between the innovation center's different departments

32 In fact, (subsidiaries of) the two companies apply and use a similar knowledge and technology base and have worked on joint R&D projects.

33 The company's newly developed products consistently come out as national innovation champions as judged by consumers.

and R&D satellites.

The data at the second site was collected at a Research and Development lab of a Dutch based multinational chemical company (*Company Y*) with offices and production facilities in 49 countries around the world. The company, which has annual sales of over €8 billion, operates across a broad spectrum of business activities including nutritional and pharmaceutical ingredients, performance materials and industrial chemicals. The company is structured into a number of clusters which are further subdivided into fairly autonomous operating business groups responsible for product development, manufacturing and sales. These divisions are organized according to the different product-market segments in which the company offers its products. In the recent past, the company shifted away from offering bulk products towards offering specialty and higher value added products. This shift resulted in an even stronger focus on technology and innovation making it an integral part of the companies' strategy. The company commits a substantial percentage of its resources to that end and undertakes numerous initiatives to stimulate and improve overall innovativeness. Following a local effort to further enhance innovation performance via internal cooperation and knowledge sharing, there was an interest in finding ways to improve local work practices within as well as between the different departments.

5.2.2 Research Method

This study combines qualitative and quantitative[34] research methods as a means to explore the object of study. Both methods are associated with specific strengths, while building on the same logic of inference, which combined can potentially provide a richer and more complete understanding of reality (Lee, 1999; Cassel and Symon, 1994; Yin, 2003). The two methods can be combined in various ways (Lee, 1999). Qualitative research is oftentimes used to lay the ground work[35] for fruitful quantification (and visa versa) (Kuhn, 1961), and in that sense this study is no different leading us to apply the dominant-less dominant design (*ibid*). Specifics with regards to the two methods and the data collection method this study utilized are provided in the next sections.

5.2.2.1 Qualitative research approach

With the research object of this study being a complex social phenomenon, the qualitative methodology makes for an appropriate and useful method. The methodology, used across various disciplines and subject matters (Denzin, et al., 2005), is considered to be especially appropriate when it comes to interpreting and understanding social phenomena and processes (see also King et al., 1994; Yin, 2003; Silverman, 1993). In line with our aim to explore human behavior the method tries to investigate *how* and *why* questions, more so than *what*, *where* and *when* questions (*ibid*). Above all qualitative research allows

34 Quantitative research is the systematic scientific investigation of quantitative properties and phenomena and their relationships (Wikipedia, 2008).

35 Kuhn (1961, p. 162) concluded "large amounts of qualitative work have usually been prerequisite to fruitful quantification in the physical sciences".

researchers to examine a phenomenon in-debt in its real life context (Yin, 2003). As a result it enables researchers to infer causal relations in their real setting (Miles and Huberman, 1994; Numagami, 1998; Yin, 2003), allowing for the exploration of contemporary issues and of developing and expanding theory (Eisenhardt, 1989). Hence, smaller more focused samples are generally preferred over large random samples on which quantitative research relies. Data collection was conducted using multiple sources including interviews, electronic survey and archival data following the notion that the different sources of evidence are highly complementary. The relatively time intensive nature of this approach was justified by its contribution to overall study quality by allowing for triangulation of the data (Yin, 2003). In reporting our findings, we have sought to combine our quantitative findings with the richness of case base research using "thick descriptions" (Geertz, 1973). Of which the latter tries to provide insight in the context as well, such that the behavior becomes meaningful to an outsider. Thus, the more traditional quantitative measures from structural network theory will be complemented, if so required, with descriptive insights from respondents in order to provide a 'richer' and more 'complete' understanding.

5.2.2.2 Qualitative data collection

Data was obtained by a total of 38 face-to-face semi-structured pro forma interviewsover a period of 4 months from 2006 to 2007, as listed[36] in Table 5-2. The interviews, of which a small number were conducted in English and the remaining in Dutch, were designed to cover managers as well as researchers. It was agreed with the senior R&D manager and main sponsor of the study that all higher level research and management staff would be interviewed. Subsequently, interviews were conducted with 3 managers and 34 associate en senior researchers.

The interviews were conducted to gain an in-debt understanding of knowledge and resource exchange that took place between researchers. Interviews were carried out using the same outline for every interview. First, by way of introduction the research topic was introduced and respondents were asked to describe their jobs, internal and external networks and the role of knowledge exchange in their specific job. Second, respondents were asked to describe past experiences with resource/knowledge exchanges as well as a number of specific questions related to this issue. In keeping with the characteristics of the different data gathering methods; the interviews were designed to balance the advantages and drawbacks of the methods employed. Interviews were employed because of their effectiveness in uncovering and exploring complex (social) issues (Harrison, 1994; Segers, 1983; Saunders et al., 2000). The interviews were semi-structured; in order to provide for focus, reliability and increased validity (Yin, 2003) given the notion that questions can be repeated across interviewees, while at the same time allowing for flexibility to probe deeper and ascertain interpretation and motivations of the interviewee.

36 In addition, interviews, not listed in table 5-2, were conducted at Company Y.

Given that interviewing by its very nature is time consuming and our research design intended to investigate a sizable sample, the interview methodology needed to be complemented with a different methodology. The use of a quantitative research methodology allowed us to collect data on a large scale as well as probe for quantifiable relationships between variables.

Table 5-2 Company X: Interviewee Description

Person	Education	Years in Current Firm	Job Grade	Age	Sex
1	Msc.	3	Scientist	34	M
2	Ph.D.	5	Supervisor	44	M
3	Msc.	3	Supervisor	33	M
4	Msc.	3	Supervisor	36	M
5	Msc.	3	Scientist	33	M
6	Msc.	4	Scientist	29	F
7	Ph.D.	17	Senior Scientist	51	M
8	Ph.D.	5	Supervisor	43	M
9	Msc.	5	Scientist	28	F
10	Msc.	4	Scientist	31	M
11	Ph.D.	20	Supervisor	57	M
12	Ph.D.	1	Supervisor	37	M
13	Msc.	4	Supervisor	30	M
14	Ph.D.	4	Supervisor	38	F
15	Ph.D.	18	Supervisor	48	M
16	Ph.D.	7	Supervisor	41	M
17	Ph.D.	1	Scientist	30	M
18	Msc.	30	Scientist	53	M
19	Msc.	3	Scientist	29	F
20	Msc.	7	Scientist	41	F
21	Ph.D.	1	Scientist	30	M
22	Msc.	11	Scientist	36	F
23	Msc.	2	Scientist	30	F
24	Msc.	21	Senior Scientist	45	F

Person	Education	Years in Current Firm	Job Grade	Age	Sex
25	Msc.	18	Senior Scientist	44	M
26	Msc.	10	Senior Scientist	38	F
27	Msc.	3	Scientist	37	F
28	Msc.	26	Senior Scientist	49	M
29	Ph.D.	22	Senior Scientist	58	M
30	Msc.	39	Senior Scientist	54	M
31	Msc.	8	Senior Scientist	37	F
32	Ph.D.	11	Supervisor	42	M
33	Msc.	2	Supervisor	42	M
34	Msc.	17	Scientist	41	F
35	Msc.	28	Scientist	48	M
36	Msc.	1	Scientist	34	M
37	Msc.	1	Scientist	42	M
38	Msc.	1	Scientist	26	F

5.2.2.3 Quantitative research approach

The quantitative part of this study, adhering to Cassel and Symon's (1994) advice to "count the countable", strives to find further empirical support for both the theoretical and empirical findings formulated in the study. This type of research typically starts with the formulation of theory or hypotheses, representing a set of expectations, which can be based on the results of qualitative research, directing the selection of research populations in order to gather quantitative data. In order to test relations posited in the conceptual framework, the data for this study was gathered at two Dutch multinational. Given the number of respondents as well as general accepted methodology for network studies in an organizational setting it was decided to administer a network survey (Borgatti and Cross, 2003; Wasserman & Faust, 1994). Following the importance of questionnaire design for data quality in self-administered questionnaires (Dillman, 1978; de Leeuw, Hox & Huisman, 2003) special attention was given to survey design. The survey was designed to be user-friendly that is; easy to understand and operate. This meant that; question wording and number of categories (e.g. Leigh and Martin, 1987; Krosnick and Fabrigar, 1997) were recognized to represent an important issue and tested exhaustively as well as an ergonomic layout (e.g. questionnaire logic and questionnaire flow) of the questionnaire and embedded instructions were provided

(Jenkings & Dillman, 1997). As certain questions in the survey could be considered sensitive in the eyes of the respondent; the use of computer assisted interviewing was considered especially appropriate since this method is associated with more self-disclosure (e.g. Richman, Kiesler, Weisband, and Drasgow, 1999).

5.2.2.4 Quantitative data collection

Management in both companies agreed to the use of a network questionnaire, which was tailored for the specific setting and administered to a total of 232 researchers and project managers. The target population represented all senior researchers (lab assistants e.g. were excluded) and project managers employed by the participating R&D labs. The decision to include all research and project managers in the study meant that our survey could potentially achieve a complete network overview.

After signing a confidentiality agreement with the company, agreeing not to disclose the companies' identity, a pilot design of the survey instrument was developed, which was pre-tested in a number of one hour semi structured interviews with project managers and researchers. The preliminary interviews were conducted to better understand the context and to ensure appropriate response categories and wording for the questions prepared for the questionnaire. The final version of the survey was then distributed to the target population by email[37] with the request to fill out the digital survey within one week. After three weeks, approximately fifty-five percent of the R&D network questionnaires were completed. We then sent out a personalized reminder in case of non response (e.g. first-level non response (unit) and second-level non response (item)). In the end, our study achieved 97 percent survey response rates for the target population.

The survey instrument. Our data were collected through a questionnaire survey distributed via email during 2007. The survey was presented and administered in a digital form using a PHP survey program tool developed especially for this project. The survey design allowed us to collect both relational and non-relational data; the former were obtained employing socio-metric techniques. The first section, dealt with the respondents contact network. This part of the survey comprised of a name generator and a number name interpreters. The name generator asked respondents to complete a standard ego-centered assessment (Marsden, 1990) identifying their most important work contacts[38], focusing on the past 6 months. The name generator questions used for this study were adapted from questions used by Burt (1992) and Podolny and Baron (1997). Respondents were then asked about the contacts they had listed via a number of name interpreter questions. These questions (See appendix A for an overview of the most important survey questions) included; length of relationship, frequency of contact, the extent to which their contacts knowledge base was

37 Distribution of the survey in company X was not done by email but by means of an assigned work station.

38 Following concerns about the length of the questionnaire and to maximize the likelihood that all the follow up questions regarding the quality of the relationship would be provided for each contact we chose to limit the number of alters respondents could name.

similar/dissimilar to their own, closeness etc (e.g. Marsden, 1990). The second section of the questionnaire elicited general demographic information, including gender, tenure with the company, length of time in current job and educational history. In the third and final section of the survey non relational data were gathered mostly through questions anchored around 5 point Likert-type scales. The questions focused on the respondent's attitude towards sharing knowledge and the exchange of favors in general. A value of '1' was generally associated with 'completely disagree', whereas a value of '5' generally implied 'completely agree'. In order to reduce the possibility of social desirability bias (e.g. Arnold & Feldman, 1981) we took a number of precautions; 1) respondents were assured that all individual responses were completely confidential 2) confirmation was provided to respondents that the analyses would be restricted to an aggregated level that would prevent the identification of any individual, and 3) arranged for a survey tool that would transfer all completed questionnaires directly to us instead of being routed through the company.

Every respondent received a personalized cover email introducing the project to the respondent, signed by the two senior R&D managers to improve response rates (For more information see appendix B) as well as the researcher. The email contained a link which, incorporating a personal identification code[39], redirected the respondent to the digital survey. To further reduce the time required to complete the survey, which took approximately 20 to 30 minutes to complete, the survey form was constructed using a matrix orientation, such that names listed could easily be linked to the name interpreter questions. In addition, the name generator screen presented respondents with a list of all researchers and project managers in the sample both to facilitate completion of the survey and to reduce ambiguity concerning contacts' identities. Following ego-network protocol and in order to keep the questionnaire length reasonable, respondents could list up to 7 contacts for each of the two R&D units [total 14 names]. The survey was sent out through intra company mail from the office of the R&D managers. The decision to send the survey via internal mail rather than from a university address served a two-fold purpose, partly to signal the company's support allowing us to increase survey response rates and partly because possible technical issues, related to mail delivery and specific I.T. configurations, could be prevented or managed by the company.

5.3 Data and Analysis

Both qualitative and quantitative research methods yield, whenever carried out successfully, different types of data. More to the point, more often than not research yields not just some data but an abundance of data. Making sense of large datasets requires a systematic way of viewing and summarizing gathered data with the aim of developing conclusions. Data analysis then can be defined as " the process of examining, categorizing, tabulating, testing or otherwise recombining both quantitative and qualitative evidence to address the initial propositions of a study" (Yin, 2003). This research combines both exploratory and

39 The personal identification code was used to address concerns for confidentiality, endemic to network studies.

confirmatory data analysis, as we hope to uncover new relationships and expect to confirm/ falsify existing hypotheses. This paragraph first discusses the unit of analysis of this study (paragraph 5.3.1) after which the primary method of analysis is reviewed (paragraph 5.3.2), finally paragraph 5.3.3) presents the variables relevant for this study.

5.3.1 Unit of analysis

Knowledge sharing obviously can take place with and between different organizational entities (e.g. individuals, departments, organizations). As such a range of different research perspectives are possible necessitating choices regarding the unit of analysis. The unit of analysis provides amongst other things research focus, in the absence of which every research runs the risk of being spread to thin and ending up saying nothing about everything. In line with the focus of this study; the micro processes of knowledge sharing, this research takes the individual as the unit of analysis, meaning that the major entity being analyzed here is individuals[40]. In addition to a focus on the individual following our micro perspective, the theoretical foundation for such a choice is well grounded in literature. Although innovation, which is essentially a new idea (Van der Ven, 1986; p. 591), can be described as an organizational outcome, it always involves individuals[41] (Glynn, 1996; Amabile, 1988; Woodman et al., 1993). This research takes the differences at the individual level (e.g. exchange and network variables) as a starting point to explore differences in innovation performance.

5.3.2 Analysis

For the analysis, we collected relational (dyadic level data) and non-relational attributes to test several hypotheses at the individual level. The set of resulting variables will be described in the next paragraph. A total of 232 respondents[42] were surveyed of which 6 did not complete the survey. As a result the dataset included 226 respondents which were involved in 1334 relationship[43] translating into an average of 6,1 contacts per respondent.

In order to make sense of the data collected this study, in line with quantitative analysis methods, will offer descriptive and inferential statistics. The latter allows us to go beyond description and move towards rejection or confirmation of our predictions. The empirical relationships and associations are studied using a general linear model frequently referred to as regression analysis. Regression analysis involves making quantitative estimates of

40 Within this study the unit of analysis is the same as the unit of observation, which represents the unit on which we collected our data.

41 For example Amabile (1988; 126) defined creativity as "the production of novel and useful ideas by an individual or small group of individuals working together".

42 The target population of 232 respondents represented the target scientists from both research settings.

43 Missing, incomplete or superfluous data required us to remove 766 dyads or observations. Only entries which provided all corresponding alter related information could be used for analysis. Superfluous data represents instances where respondents filled out the survey twice, usually occasioned by user-related inter/intranet settings.

theoretical relationships between variables[44,45]. Regression analysis thus enables us to study causal relationships by means of the manipulation of factors relevant for our research topic while controlling for variables which are thought to be relevant in terms of their impact on experimental outcomes. However, although statistical models can imply causation they cannot inform us about the nature of causality only theory can.

Exploration of some aspects of the process of exchange between R&D scientists required us to make use of relational data (dyadic level data). Relational data precludes the use of standard statistical tools for the analysis of variables to examine inferential questions (e.g. hypothesis or significance tests) (e.g. Hanneman & Riddle, 2005) due to the fact that the observations do not represent independent observations drawn at random from some larger population. To put it differently for each respondent we can have multiple observations as well as multiple observations for each contact (Reagans & McEvily, 2003). As a result the regression standard errors are correlated across observation from the same source of object of a relationship. Key Ordinary Least Squares regression (OLS) assumptions are violated leading to an artificial reduction of the estimates (i.e. standard errors). We therefore need to account for the non-independence of standard errors of the estimates. The use of random permutations will allow for the computation of basic linear multiple regression statistics by OLS, and the generation of correct standard errors and significance. Whenever appropriate we will use a permutation based multi-variate linear regression statistic to calculate the correlation coefficient (r-square) and the standardized regression coefficient (beta).

UCINET VI (Borgatti, Everett, & Freeman, 1992) was used to analyze the network data and to test how relational independent variables contributed to the dependent variables using permutation based linear regression analysis. Standard statistical analysis of variables was conducted with SPSS (version 15).

5.3.3 Measures

Research data was gathered through a survey instrument and semi-structured interviews. Given our interest in the micro-processes of knowledge exchange the semi-structured interviews were used to shed additional light on the processes and causal relationships that underlie the networks as suggested in the literature. Quantitative indicators of the various network dimensions were collected using standardized name generator and name interpreter questions via an online survey instrument. The survey methodology enabled the large scale collection of both relational attributes (e.g. in-degree centrality, brokerage etc.) measured at the dyadic level and non-relational attributes (e.g. gender, age, tenure at the organization etc.). The survey questions and required measures were whenever possible adopted, and if

44 In: Introduction to regression. (Carey, 2007).

45 Or as Field (2005) succinctly explains "we fit a statistical model to our data and see how well it fits the data (in terms of the variance it explains). If it fits the data well (i.e. explains a lot of the variation in scores) then we assume our initial prediction is true: we accept the experimental hypothesis".

so required adapted, from previous research.

5.3.3.1 Dependent, independent and control variables.

Innovation performance. Individual's innovation performance was measured on two dimensions as suggested by Rodan and Galunic (2004). The first item assessed individual creativity and the second item represented a measure of implementation effectiveness with regard to new ideas. Individual creativity was measured by means of a performance item which asked managers to carefully rate the researcher's creativity over the last 6 months. [To what extent is this person particularly creative: someone to come up with novel and useful ideas, using a 1-5 scale, from weak to outstanding]. The implementation measure asked managers to carefully rate the researcher ability to implement novel ideas over the last 6 months. [To what extent is this person particularly good at implementing novel ideas, using a 1-5 scale, from weak to outstanding]. The use of this type of measure to ascertain innovativeness followed the notion that measurement of innovativeness at the individual level, as pointed out by literature, oftentimes requires supervisor (or peer) assessment (Amabile, 1996; Moran, 2005; Avery and Murphy, 1998). In line with previous research the assessment asked managers to asses behaviors not attitudes, for a specific period (cf. Tsui, 1984). Interviews with senior managers at the organization suggested that line management would be most appropriate for ascertaining researcher's individual innovation performance, given their direct involvement with and formal responsibility to rate these researchers.

Number of patents. In order to complement our individual level data we sought an alternative method of measuring individual innovativeness. The number of patents per researcher was collected, as a proxy for innovative output [please rate the number of patents you have applied for during your tenure at company X/Y, scale 1-5]. This approach is consistent with the existing practice to measure via patents, in an indirect way, both the technological competence of a firm (Narin et al., 1987) as well as productivity for individual researchers (Bertin & Wyatt,1988).

Exchange frequency. In order to assess the frequency of favor exchange we adapted an item by Flynn (2003). Respondents could indicate for each of their selected network alters how often they exchanged favors. [Please rate the frequency with which you exchange favors with regard to the innovation development process with this person, scale 1-5, from daily, weekly, monthly, quarterly, yearly to never]. The measure was transformed into interval data by recoding to the number of exchange days [yearly = 1, quarterly = 4, monthly = 12 etc.]. An overall measure of favor exchange frequency per respondent was then calculated by averaging the reported ratings of favor exchange frequency across respondent's network contacts.

Perceived generosity. We measured favor exchange balance, which is used to measure perceived favor exchange generosity, using an item developed by Flynn (2003.) Respondents, using a 5-point likert-type scale, rated each of their selected network alters in terms of favor exchange balance [Please rate who has given more in this exchange relationship?, scale 1-5, from 'I have received far more than I have given' to 'I have given far more than I have received']. In order to create a measure of perceived favor exchange generosity the measure was reverse coded (that is, 5 was recoded as 1, 4 was recoded as 2, etc.). This resulted in a measure which captures the extent to which alters perceived the focal employee to be generous in his favor exchange with them. An increase in this measure reflects the extent to which others consider the focal employee to be generous [meaning he/she has given more than he/she received]. An overall measure of perceived generosity per respondent was, then, calculated by averaging the reported ratings of perceived generosity across respondent's network contacts.

Knowledge (dis)similarity. Building on a measure developed by Rodan and Galunic (2004) respondents were asked to assess the extent to which the knowledge base of the reported alter was similar or dissimilar to their own [How similar or different is your knowledge from your contact's knowledge?, scale 1-4; 1= very similar, 2 = similar, 3= different, 4=very different]. The measure taps into the idea that innovation is facilitated by bringing together different, though not too different (cf. cognitive distance), knowledge bases (heterogonous knowledge) (Burt, 2004; Pelled, Eisenhardt & Xin, 1999; Nooteboom, 1992, 1999, 2000). The measure was reverse coded (that is 4 was recoded as 1, 3 was recoded as 2, etc.) so as to have a value increase reflect increased knowledge similarity.

In-degree centrality. In-degree centrality provides us with a basic indication of the network structure of an individual actor also referred to in social network analysis as degree centrality (Wasserman & Faust, 1994). Each respondent was asked to list his or her key contacts, with a possible range from 0 tot 14 ['Over the past 6 months are there any work related contacts from whom you regularly sought (research related) information and advice to enhance your effectiveness as a researcher? Your most valued work contacts']. For the purpose of this study the in-degree statistics, which is the total number of unique direct ties reported by alters with the focal actor, for each actor were calculated. We did not require that the contact corroborate the tie, following that the number of alter respondents could select ranged between 0 and 14. The presence of asymmetric relationships, representing non-reciprocated ties, is to be expected between prominent and less prominent network actors[46] which form an important indication of an actor's position. As it is precisely these relationships we are interested in, the in-degree centrality measure is used to ascertain an actor's prominence within the network. In-degree ties provide insight in the number of sources that send information or resources to the focal actor. Put differently, the higher the

46 Knoke and Burt (1983: 199) point out that in network research: "Prominent leaders are the object of extensive relations from followers, while the latter are the objects of few relations.

in-degree the more an actor is in direct contact with many alters. Total number of unique contacts ranged between 0 and 42 for this data set, meaning that some actors had up to 42 reported contacts (Average: 9,2, Median: 7,5, S.D: 7,19). As reported in the frequency distribution of network size in Table 5-3 most respondents [62,9 %] commanded networks between 2 and 11 contacts.

Table 5-3 Frequency Distribution of Indegree-Centrality

# of direct ties	Frequency	Percent	Cumulative
1	9	4	4
2	14	6,3	10,3
3	28	12,5	22,8
4	18	8	30,8
5	14	6,3	37,1
6	15	6,7	43,8
7	14	6,3	50
8	14	6,3	56,3
9	12	5,4	61,6
10	16	7,1	68,8
11	10	4,5	73,2
12	8	3,6	76,8
13	7	3,1	79,9
14	3	1,3	81,3
15	5	2,2	83,5
16	6	2,7	86,2
17	5	2,2	88,4
18	4	1,8	90,2
19	2	0,9	91,1
20	1	0,4	91,5
21	2	0,9	92,4
22	3	1,3	93,8
23	4	1,8	95,5
24	3	1,3	96,9
25	1	0,4	97,3
26	1	0,4	97,8

# of direct ties	Frequency	Percent	Cumulative
27	1	0,4	98,2
34	1	0,4	98,7
37	1	0,4	99,1
41	1	0,4	99,6
42	1	0,4	100
Total	**224**	**100**	

Gender. Information about the gender of the respondent, as a demographic attribute with possible explanatory value, was gathered using the survey instrument (dummy variable: female =1, male =0) (Female: 23 percent, Male: 87 percent).

Age. Information about the age of the respondent, as a demographic attribute with possible explanatory value, was gathered using the survey instrument (years) (Average: 44; S.D.: 9).

Lab size. Following Tortoriello (2006) unit size was taken into account. As a contextual factor the number of people working at a given department could be an important factor of networking and exchange opportunities. The measure was operationalized by taking the Log[47] of the number of people working in a given lab.

Tenure. Respondents were asked to report their tenure in the organization (years), as a possible explanation for performance (Average: 14,6; S.D.: 11,32, Minimum: 1, Maximum: 43).

Seniority. The hierarchical position of the respondents was included for its potential explanatory power with regard to performance and network position. Our seniority measure was based on company personnel data. The data was used as a basis for our measure of hierarchal level [scientist, senior scientist and science manager]. These possible outcomes were converted into a dummy variable [0= scientist, 1 = senior scientist, 2= manager].

Tie strength. Relational strength was measured by asking respondents to assess 'closeness' and 'communication frequency' with respect to their alters (Granovetter, 1973; Fischer, 1982; Burt, 1984; Hansen, 1999). Tie strength was then calculated as the sum of these two measures, which according to literature represent different yet related dimensions of tie strength (Marsden & Campbell, 1984; Reagans and McEvily, 2003).

Respondents were asked to describe the relationship with each selected alter in terms of

47 The logarithmic is useful for transforming positively skewed data (Field, 2005), as such it brings the values closer together.

these two measures. Closeness allowed us to ascertain how close the relationship with each contact was. [How close is your working relationship with the person in question? scale 1-5; 1 = especially close, 5 = distant]. An overall measure of closeness per respondent is calculated by averaging the reported rating of closeness across a respondent's network contacts. Similarly, respondents were asked to report the communication intensity with the selected alters. [How frequently did you interact with the person in question?, scale 1-5; from daily, weekly, monthly, quarterly to yearly]. The measure was transformed into interval data by recoding to the number of exchange days [yearly = 1, quarterly = 4, monthly = 12 etc.]. The overall communication frequency measure per respondent was then calculated by averaging the reported ratings of communication frequency across respondent's network contacts. The joint distribution between the two dimensions of tie intensity, emotional closeness and communication intensity, is shown in Table 5-4. As becomes apparent from the table, on average individuals felt closer to those alters they communicated with more frequently.

Table 5-4 Joint Distribution of Tie-strength Variables

	Communication Frequency				
Emotional Closeness	**Daily**	**Weekly**	**Monthly**	**Quaterly**	**Less often**
Especially Close	158	58	19	17	4
Close	203	281	134	102	54
Neutral	76	157	178	234	143
Somewhat distant	17	13	28	56	67
Distant/ arms length	15	2		12	34

Tie strength was, then, in line with prior research, calculated by relating tie intensity to network proportions (Burt, 1992; 2004; Uzzi, 1996, 1999; Reagans and McEvily, 2003). Following Reagans and McEvily (2003), we used the following formula:

$$p_{ij} = z_j \Big/ \sum_{q=1}^{N} z_{iq,q=j}$$

In the equation p_{ij} reflects tie strength from respondent i to contact j, where z_{ij} is the relational intensity [computed as the product of emotional closeness and communication intensity] from respondent i to contact j and $\sum_{q=1}^{N} z_{iq,q=j}$ defines tie strength in terms of network proportions providing us with the context of the aggregate level of intensity across a person's network.

Brokerage. The variable brokerage provides insight into the extent to which an ego connects other pairs of actors which are not directly connected, where brokerage has been associated

with different benefits (competitive advantages as well as creative benefits) (Burt, 1992; 2004; Rodan & Galunic, 2004; Henze & Bauer, 2007; Cross & Cummings, 2004). The brokerage index measures the percentage of alters in ego's network which are not directly connected to one another (Hanneman & Riddle, 2005). It thus provides insight into ego's potential for brokerage. Formally:

$$\text{Network brokerage index} = p_{ij} \quad \frac{(n^2 - n) - \sum_{i-1}^{n} \sum_{j=1}^{n} x_j}{(n^2 - n)}$$

The equations above represents the brokerage index, where n is the number of ego's alters, $(n^2 - n)$ the number of potential pairs between alters without ego, and x_{ij} reflects the number of ties between alters excluding ego. The theoretical range of this measure ranges from 0 to 1, where 1 represents a 100 percent connection rate between alters. Calculation of this measure was done by means of UCINET 6.0 (Borgati et al., 2002). More specifically, the in-neighborhood normalized broker measure provided by the ego-network routine was used. This measure reflects the individual level of brokerage opportunity.

5.4 Validity

5.4.1 Introduction

As the aim of any empirical investigation is to either test hypotheses from existing theory or formulate new theory with the aim of expanding current theory, the research must be designed accordingly. The particular research strategy[48] (e.g. Saunders et al., 2000; Yin, 2003; Silverman, 1993; Verschuren & Doorewaard, 2001) embodied in the research design chosen must reflect the particular research questions as well as ensure research quality. Especially relevant for ensuring and judging research quality, irrespective of whether the type of approach is qualitative or quantitative, are the concepts of validity[49] and reliability[50]. The research design chosen incorporates the principles of triangulation in order to improve the strength of the main conclusions (Denzin, 1978; Jick, 1983; Yin, 2003; Silverman, 1993; Bijlsma-Frankema & Drooglever-Fortuijn, 1997 ;Saunders et al., 2000). The method aims to cancel out the method effect (Saunders et al., 2000) and to overcome the possibility of context-boundedness of the gathered data (Silverman, 1993) thus improving credibility and validity of the results. Although different types of triangulation can be discerned (Denzin, 1978), between-method triangulation involving the use of different data collection methods is generally considered both appropriate and viable (Jick, 1983). In response to these

48 A research strategy can be defined as a series of decisions with regard to the way the research object will be investigated, and the research in general will be handled (Verschuren & Doorewaard, 2001).

49 Validity refers to and is defined as the veritability of observations and conclusion one draws on its basis (or put differently does one measure what one set out to measure) (Bijlsma-Frankema & Drooglever-Fortuijn, 1997).

50 Reliability refers broadly to the consistency of observations (Bijlsma-Frankema & Drooglever-Fortuijn, 1997) and its overall goal is to minimize the errors and biases in a study (Yin, 2003).

recommendations, the study set up incorporates multiple observers/data sources as well as a multi-method approach, meaning that both quantitative and qualitative methodologies were used. Though both methods were used the qualitative elements of this study, following a dominant-less dominant design approach, have to give way to the quantitative part of this study in terms of sheer breadth. Volume in this case, as in many others, is not a measure of value as qualitative research has proven invaluable in understanding the context as well as processes involved providing the depth to develop and understand the quantitative part of this study.

5.4.2 Representativeness and Generalizibility

The extend to which the findings of a study, in effect the degree to which propositions are supported by empirical evidence, are generalizable is an important issue for any type of study. Assuming that the study was conducted adequately, the question of generalizibility then becomes one of assessing the ramifications of the particular research design chosen.

The electronic survey was distributed to a population of R&D researchers in two R&D labs, located in different parts of the Netherlands. Within network analysis, one site sampling schemes are not uncommon, since this type of research design allows for the identification of a clear network boundary (e.g. Krackhardt, 1990). In that sense this study does not employ the sampling logic often associated with survey research, where the entire population of relevant respondents is identified and statistical procedures ensure that the sample surveyed can be assumed to reflect the entire population. Accordingly, given that the case research strategy follows a different logic, respective cases have been selected by means of non-probability sampling (Yin, 2003; Saunders et al., 2000; Segers, 1983).

Case selection has been based on a purposive approach (Saunders et al., 2003), meaning that from the possible research population (research domain) some research units/ instances are chosen on logical-theoretical considerations (Segers, 1983). With the research domain[51] of this study extending to the knowledge workers in R&D environments two R&D labs were selected as a site for this study. The cases were selected based on the notion that the settings closely resembled one another in terms of type of research and research population. Selection of a specific industry sector with to some extent overlapping technology bases, though not essential, aimed to further add to case similarity. Both settings emphasized knowledge transfer and cooperation, building and maintaining external networks and researched basic as well as more applied technologies

In sum, with network analysis lying at the heart of this study, where one site sampling due to the clear network boundary is a common and expedient research strategy (e.g. Krackhardt, 1990), the case study research method represents the appropriate strategy for empirical operationalization. Whenever case study research and representativeness are considered; one inevitably is required to consider the concepts of research domain and replication. Within this study the research domain, generally described as the specific and

51 The research domain of a theory is defined as the universe of all different instances of the object of study to which the theory applies (Dul & Hak, 2007).

concrete system from which elements for research are chosen and for which the propositions of the theory are believed to be true (Sjoberg & Nett, 1968 taken from Segers, 1983), has been defined as the concrete system (totality) of higher level knowledge workers within R&D labs. Analogous to a research strategy employing experiments, generalizibility with regard to case studies is the result of replication, the more cases are carried out that corroborate a theory or proposition(s), the stronger the support for that theory or proposition. Therefore the replication of results employed in analytical generalizibility[52] increases the likelihood of the results being applicable across the target population. However statistical generalization to a larger population, or statistical inference, cannot be assumed (Yin, 2003).

5.4.3 Conclusion

Every research design in essence represents a number of far reaching decisions with regard to the research strategy. The multi-method research design implemented here represents an appropriate and effective strategy for the uncovering of the mechanisms that underlie cooperation/exchange between knowledge workers. Using a qualitative methodology this study benefited from a better understanding of the social phenomena we set out to study. The results were used both to formulate specific prediction about reality and the construction of the network survey. Quantitative research was carried out in R&D labs, purposively selected on the basis of case similarity, in order to further explore and test predicted relationships. Through the combination of these different research approaches, and the triangulation of research data this approach enabled, the study essayed to provide additional insight into the micro processes of knowledge exchange.

52 Yin (2003: p.37) defines analytical generalization as an scientific method where 'the investigator is striving to generalize a particular set of results to some broader theory'.

References

Allen, T.J. (1977) *Managing the flow of technology*. Cambridge MA: The MIT Press.

Amabile, T.M. (1988), A model of creativity and innovation in organizations. In: Eds. Staw, B. M. & Cummings, L.L., Research in organizational behavior, Vol. 10: 123-167. Greenwich, CT: JAI Press.

Amabil, T.M. (1996),'Creativity in Context', Westview Press: Boulder, CO

Arnold, H.J., & Feldman, D.C. (1981), 'Social desirability response bias in self-report choice situations', *Academy of Management Journal*, 24, 377-385

Arvey, R.D., & Murphy, K.R., (1998), 'Performance evaluation in work settings', *Annual Review of Psychology*, 49, 141-168

Bertin, Gilles Y. and Sally Wyatt (1988). *Multinationals and Industrial Property*, Harvester: Wheatsheaf.

Bijlsma-Frankema, K. & Droogleever Fortuijn, E. (1997), 'De kwalitative datamatrix als analyse-instrument', *Tijdschrift voor sociale wetenschappen*, 42(4), 448-459

Borgatti, S., & Cross, R. (2003), 'A relational view on information seeking and learning in social networks', *Management Science*, 49(4), 432-445

Borgatti, S.P., Everett, M.G. and Freeman, L.C. 2002. Ucinet for Windows: Software for Social Network Analysis. Harvard, MA: Analytic Technologies.

Bouty, I. (2000) 'Interpersonal and interaction influences on informal resource exchanges between R&D researchers across organizational boundaries' *Academy of Management Journal* 43(1): 50-65

Burt, R.S. (1984), 'Network items and general social survey.', Social Networks, 6, 293-339

Burt, R.S. (1992) 'Structural holes: The social structure of competition', Cambridge, MA: Harvard UP.

Burt, R. S. (2004) 'Structural Holes and Good Ideas' *American Journal of Sociology,* 110, 442-455

Cassel, C. & Symon, G. (1994), 'Qualitative research in work contexts *In: Qualitative methods in organizational research: A practical guide,* Eds. Cassel, C. & Symon, G, London: Sage

Cross, R., & Cummings, J. (2004),'Tie and network correlates of individual performance in knowledge intensive work, Academy of Management Journal, 47: 928-937

Cross, R. & Prusak, L. (2002), 'The People Who Make organizations Go- or Stop', *Harvard Business Review*, 80 (6), 104-112

Cross, R., Parker, A., & Borgatti, S. (2001),'Knowing what we know: Supporting knowledge creation and sharing in social networks' *Organizational Dynamics* 30(2): 100-120

Denzin, N.K. (1978), The Research Act in Sociology: A Theoretical Introduction to Sociological Method, New York: McGraw-Hill

Denzin, Norman K. & Lincoln, Yvonna S. (2005), *The Sage Handbook of Qualitative Research*, Sage Publications

Dillman, D. A. (1978). Mail and telephone surveys: The total design method. New York, NY: John Wiley & Sons.

Dul, J. & Hak, T (2007), "Case Study Methodology in Business Research", Amsterdam: Butterworth-Heinemann.

Eisenhardt, K.M. (1989), 'Building Theories from Case Study Research', *Academy of Management Review*. 14(4), 532-550

Field, A. (2005). *Discovering statistics using SPSS*, (2nd ed.). London: Sage.

Fischer, C. (1982), *To Dwell among Friends*. Chicago: University of Chicago Press.

Flynn, F.J. (2003) 'How much should I give and how often? The effects of generosity and frequency of favor exchange on social status and productivity', *Academy of Management Review*, 46(5), 539-553

Freeman, C. (1991) "Networks of innovators" *Research Policy* 20: 499-514.

Geertz, C. (1973), The Interpretation of Cultures: Selected Essays, New York: Basic Books

Ghoshal, S. & Bartlett, C.A. (1988) 'Creation, adoption, and diffusion of innovations by subsidiaries of multinational corporations', *Journal of International Business Studies* 19: 365-388.

Glynn, M.A. (1996), Innovative Genius: A Framework for Relating Individual and Organizational Intelligence to Innovation, *The Academy of Management Review*, Vol. 21 (4), pp.1081-1111

Granovetter, M.S. (1973) 'The Strength of Weak Ties' *American Journal of Sociology* 78, 1360-1380

Hanneman, R. A. and Riddle, M., 2005. *Introduction to social network methods*. Riverside, CA: University of California, Riverside (published in digital form at http://faculty.ucr.edu/~hanneman/)

Hansen, M.T. (1999) "The Search-Transfer Problem" *Administrative Science Quarterly* 44(1): 82-111.
Harrison, M.I. (1994), Diagnosing Organizations: methods, models, and processes 2nd edition, London: Sage Publication
Henze, T., & Bauer, G. (2007), 'Characterizing creative scientists in nano-S&T: Productivity, multidisciplinary, and network brokerage in a longitudinal perspective', Scientometrics, Vol. 70 (3), 811-830
Jenkins, C.R., & Dillman, D.A. (1997), 'Towards a Theory of Self-administered Questionnaire Design', *In: Survey Measurement and Process Quality*, Eds. Lyberg, L., Biemer, P., Collins, M., de Leeuw, E., Dippo, C., Schwarz, N., & Trewin, D. ,New York; Wiley
Jick, T. (1983), 'Mixing Qualitative and Quantitative Methods: Triangulation in Action', *In: Qualitative Methodology,* Ed. Maanen van, J. London: SAGE
Kim, W.C., & Mauborgne, R. (1998), 'Procedural Justice, Strategic Decision Making, and the Knowledge Economy', *Strategic Management Journal*, 19(4), 323-338
King, G., Keohane, R.O., & Verba, S. (1994), Designing Social Inquiry: Scientific inference in qualitative research.
Princeton University Press: Princeton (NJ)
Kogut, B., & Zander, U. (1992) 'Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology' *Management of Technology* 3(2): 383-397.
Krackhardt, D. (1990), 'Assessing the political landscape: Structure, cognition, and power in organizations', *Administrative Science Quarterly,* 35, 342-369
Kreiner, K., & Schultz, M. (1993) "Informal Collaboration in R&D." *Organization Studies* 14(2): 189-209
Krosnick, J.A. & Fabrigar, L.R. (1997), 'The Causes of No Opinion Responses to Attitude Measures in Surveys: They Rarely Are What They Appear to Be. ', *In: Survey Non response,* Eds. Groves, R.M., Fillman, D.A., Eltinge, J.L., and Little, R.J.A. , New York: Wiley
Kuhn, T.S. (1961), 'The Function of Measurement in Modern Physical Science', The History of Science Society, Vol. 52, No. 2 (Jun., 1961), pp. 161-193
Lee, T.W. (1999), Using Qualitative Methods in Organizational Research, Sage Publications: London
Leigh, J.H. & Martin, C.R. (1987), 'Do-not-know Item Non response in Telephone Surveys: Effects of Question Form and Respondent Characteristics', *Journal of Marketing Research*, 24, 418-424
Leeuw, E.D. de., Hox, J., & Huisman, M. (2003), 'Prevention and Treatment of Item Non response', *Journal of Official Statistics*, 19(2), 153-176
Leyendorf, L., & Dolfsma, W., (2008), 'Het Nederlandse Innovatiesysteem', *ESB*, 4 april 2008, pp. 214-215.
Madhaven, R., & Grover, R. (1998), 'From embedded knowledge to embodied Knowledge: New product development as knowledge management', *Journal of Marketing*, 62, 1-12
Marsden, P.V. (1990), 'Network data and measurement', *Annual Review of Sociology*, 16, 453-463
Marsden, P.V., & Campbell, K.E (1984), 'Measuring tie strength.', Social Forces, 63, 377-401
Miles, M.B. & Huberman, A.M. (1994), *Qualitative Data Analysis 2nd edition*, Thousand Oaks, CA: Sage
Moran, P. (2005),'Structural vs. Relational Embeddedness: Social Capital and Managerial Performance', Strategic Management Journal, 26, 1129-1151
Moran, P., & Ghosal, S. (1996) 'Value creation by firms', In: *Academy of Management Best Paper Proceedings*, Eds. Keys, J.B. & Dosier, L.N.
Nahapiet, J., & Ghosal, S. (1998) 'Social capital, intellectual capital, and the organizational advantage', *Academy of Management Review*, 23(20), 242-266.
Narin, F., Noman, E. & Perry, R., 1987. Patents as indicators of corporate technological strength, Research Policy, 16 (2-4), 26-48.
Nooteboom, B. (2000), *Learning and innovation in organizations and economies*, Oxford: Oxford University Press.
Nooteboom, B. (1999), *Inter-firm alliances: Analysis and design*., London: Routledge
Nooteboom, B. (1992), Towards a dynamic theory of transactions, Journal of Evolutionary Economics, 2: 281-299

Numagami, T. (1998), 'The Infeasibility in Invariant Laws in Management Studies: A Reflective Dialogue in Defense of Case Studies', *Organization Science*, 9(1), 2-15

Pelled, L.H., Eisenhardt, K.M., & Xin, K.R. (1999), 'Exploring the black box: an analysis of work group diversity, conflict, and performance.', Administrative Science Quarterly, 44(1), 310-326

Podolny, J.M., & Baron, J.N. (1997), 'Resources and relationships: Social networks and mobility in the workplace', *American Sociological Review*, 62, 673-693

Reagans, R. & McEvily, B. (2003), 'Network Structure and Knowledge Transfer: the Effects of Cohesion and Range', *Organization Science,* 13(3), 232-248

Richman, W., Kiesler, S., Weisband, S., & Drasgow, F. (1999), 'A Meta-analytic Study of Social Desirability Distortion in Computer-administered Questionnaires, Traditional Questionnaires, and Interviews', *Journal of Applied Psychology*, 84, 754-775

Roberts, E.B., & Fusfeld, A.R. (1981), 'Staffing the innovative technology-based organization', *Sloan Management Review*, 22(3):19-34

Rodan, S., & Galunic, C. (2004), 'More Than Network Structure: How Knowledge Heterogeneity Influences Managerial Performance and Innovativeness', Strategic Management Journal, 25, 541-562.

Saunders, M., Lewis, P., & Thornhill, A. (2000), *Research Methods for Business Students, 2nd edition*, Financial Times Prentie Hall: London

Segers, J.H.G. (1983), Methoden voor de sociale wetenschappen Deel 1; Inleiding tot de structuur van het onderzoeksproces en tot de methoden van dataverzameling.,Van Gorcum: Assen

Silverman, D. (1993), Interpreting Qualitative Data: Methods for Analyzing Talk, Text and Interaction, Sage Publications: London

Szulanski, G. (1996) 'Exploring internal stickiness' *Strategic Management* 17: 27-43.

Tortotiello, M (2006), 'The social underpinnings of absorptive capacity: external knowledge, social networks, and individual innovativeness', Academy of Management Best Paper Proceedings

Tsai, W. (2001), 'Knowledge transfer in intra-organizational networks: Effects of network position and absorptive capacity on business unit innovation and performance', *Academy of Management Review,* 44, 996-1004

Tsai, W. & Ghosal, S. (1998) 'Social Capital and Value Creation: The role of intra firm networks', *Academy of Management Journal* 41 (4), 464-476.

Tsui, A.S. (1984),'A role-set analysis of managerial performance reputation', Organizational Behavior and Human Performance, 34, 397-418

Uzzi, B. (1996),'The sources and consequences of embeddednes for the economic performance of organizations: The network effect.', *American Sociological Review*, 61, 674-698

Uzzi, B. (1999),'Social relations and networks in the making of social capital', *American Sociological Review*, 64, 481-5-5

Van de Ven, A.H. (1986), Central Problems in the Management of Innovation, *Management Science*, Vol. 32 (5), 590-607

Verschuren, P. & Doorewaard, H. , (2001), *Het ontwerpen van een onderzoek*, Utrecht: Lemma

Von Hippel, E. (1987) 'Cooperation between rivals: Informal know-how trading' *Research Policy* 16: 291-302.

Wasserman, S., & Faust, K. (1994), *Social Network Analysis: Methods and Applications.*, Cambridge, England: Cambridge University Press

Winter, S.G. & Szulanski, G (2001), 'Replication as Strategy, *Organization Science* 12(6): 730-743.

Woodman, R.W., & Sawyer, J.E., & Griffin, R.W. (1993), Towards a theory of organizational creativity, *Academy of Management Review*, 18: 293-321

Yin, R.K. (2003), *Case Study Research: Design and Methods 3rd edition*, Sage Publications: Thousand Oaks, California

Appendix A

	Summary of Key Survey Questions
Name generator	Part of the main survey send to all selected participants.
	Over the past 6 months are there any work related contacts from whom you regularly sought (research related) information and advice to enhance your effectiveness as a researcher? Your most valued work contacts.' (cf. Burt, 1992; Podolny and Baron, 1997; Marsden 1990).
Name interpreters	Part of the main survey send to all selected participants.
Respondents answered the questions below on a 5-point scale, ranging from 1 to 5 [ranging from daily to yearly].	1. How frequently did you interact with the person in question? (cf. Wasserman & Faust, 1994; Burt, 1992)
	2. How similar or different is your knowledge from your contacts' knowledge? (cf. Rodan and Galunic, 2004)
	3. How close is your working relationship with the person in question? (cf. Marsden & Campbell, 1984; Burt, 1992)
	4. Please rate the frequency with which you exchange favors with regard to the innovation development process with this person (very infrequently vs. very frequently)? (cf. Flynn, 2003).
	5. Please rate who has given more in this exchange relationship? (cf. Flynn, 2003).
Assessing innovation performance	Part of the survey send to senior managers asked to assess performance of employees in their team.
Respondents answered the questions below on a 5-point scale, ranging from 1 to 5 [ranging from weak to outstanding].	Please write the number from the 5-point scale that best corresponds to your assessment of this knowledge workers performance over the last 6 months. (cf. Rodan and Galunic, 2004).
	1. To what extent is this person particularly creative: someone able to come up with novel and useful ideas?
	2. To what extent is this person good at implementing novel ideas?
Control variables	
	1. What is your age?
	2. Please indicate your tenure with the organization.
	3. Please indicate your tenure with the department you currently work for.
	4. How many scientific articles have you published during your tenure at Company X/Y?
	5. How many patens have you applied for during your tenure at Company X/Y?

Appendix B

RSM Research Knowledge Sharing

Dear Sir/Madam,

At Erasmus University Business School, research on how knowledge sharing within several Dutch companies contributes to innovation is undertaken. Within this framework, in conjunction with Company Y R&D both DFS and DAI, this survey is send to you.

Research aim
The aim of this research is to gain understanding in how knowledge is shared within and across departments and business-unit boundaries.

Why you?
The survey was pre-tested within Company Y. You have been selected as one of the people who plays an import role when it comes to knowledge sharing. Your cooperation is essential for the quality of the investigation and your participation is therefore highly appreciated.

How does it work?
Please indicate who are your most important work contacts (max. 7) within DAI and your most important work contacts (max. 7) within DFS. Also, briefly characterize your contact in the terms suggested in the survey. The electronic survey will allow you to select departments after which you can select individuals working for that particular department.

Discretion
The information you provide will be handled discretely. Names of your contacts are necessary to map relationships within networks, but will be presented in a coded form. The information that you will enter will not be visible to other respondents.

The electronic questionnaire will require approximately 20 minutes of your time. In order to complete the questionnaire just click on the following link: www.erasmusresearch.nl/companyY/en/?userid=

Please fill out and return the questionnaire by Friday, March the 30th.

Kind regards,
Also on behalf of …….. (Director R&D Company Y) and ……(Director R&D Company Y),

Rene van der Eijk, Erasmus University, (email: reijk@rsm.nl; phone: 010-4082921)

Chapter 6
Innovation Performance: Structural and Relational Determinants

6.1 Introduction

The common thread throughout this study has been the process of exchanging information and developing knowledge. Intellectual capital was shown to be a valuable resource in its own right which has become a key source of competitive advantage (e.g. Wiig, 1997). Knowledge's intangible nature sets it apart from other tangible resources. Essential to knowledge generation, in a large part because of its cumulative nature, is its transfer; since in the giving and receiving of knowledge lays the key to multiplying it. Using past research as a starting point, the preceding chapters explored different bodies of literature on the practice of knowledge exchange. It became clear that in terms of explaining the transfer of knowledge the field owes a lot to network theory (e.g. Allen, 1977; Tushman, 1977; Tushman & Scanlan, 1981; Rogers, 1995; Coleman, Katz, and Menzel, 1966). It is this field that allows us to consider the influence of the social context in which actors are embedded and how the position of actors in a network influences their actions. The social nature of human cooperation is exceedingly relevant in a context of knowledge generation as relational ties between individuals form the conduits through which knowledge and resources can be swapped (e.g. Podolny, 2001; Tsai & Ghosal, 1998; Owen-Smith & Powell, 2004). New knowledge generation requires the input of knowledge and ideas, preferably from multiple and heterogonous sources, and networks (Granovetter, 1985; Uzzi, 1996) are a means of providing access to those resources. While acknowledging the importance of networks, also dubbed the "the plumbing of the market" (Poldolny, 2001), a focus on structural elements such as an agent's position in a network and the types of relations entertained cannot explain why actors actually engage in the exchange of knowledge. Given knowledge's elusive nature, exchange can easily be avoided. Parties involved must be willing to exchange knowledge, leading us to emphasize the content of relationships as well. Gift exchange theory may provide a framework to consider both social and economic aspects of the knowledge exchange process simultaneously. It provides the parties involved with a mechanism for the exchange of resources and an incentive to so. Gift exchange was shown to incorporate altruistic as well as more self-interested motives, of which the latter are generally emphasized. Characteristics of knowledge create a context in which informal exchange becomes a relevant part of its creative and production process. Knowledge sharing can, as we have argued, be envisioned as a form of exchange where each transfer represents a gift or favor.

The chapter at hand aims to put notions we have posited in the preceding paragraphs to the test. In order to explore knowledge exchange in a real life setting, data havebeen collected at R&D laboratories in the Netherlands. R&D laboratories' principle business is the generation

of knowledge. In these and other knowledge intensive settings, knowledge sharing is recognized as an important if not essential prerequisite. In his empirical section, we aim to explore the effects of both structural network related aspects and more content related [gift] exchange variables on knowledge exchange as well as other knowledge related outcomes.

The following section, will start out with a number of key observations with regard to knowledge transfer between scientists based on qualitative research. Paragraph 6.2.2 presents a descriptive overview of the collected network data followed by a comparison of a number of selected ego-networks. In paragraph 6.3 the expected relationships between variables are introduced formally by means of a set of propositions. Paragraph 6.4 continues with a principal analysis of the effects of network and gift exchange related variables on both subjective and objective innovation related outcomes. A more in-depth analysis of the observed relationships will be presented in paragraph 6.5, after which paragraph 6.6 will explore perceived generosity and network position. Finally, the findings are discussed in paragraph 6.7.

6.2 Knowledge sharing in Dutch R&D labs

6.2.1 A qualitative approach to knowledge exchange / understanding knowledge exchange

Our study so far has been theoretical to a high degree. Taking 'knowledge sharing' as a starting point, we have explored the notion that gift exchange serves as a mechanism for knowledge sharing and as such represents a prerequisite for knowledge creation. Going from the abstract to practice, from a macro to a micro level, this section sets out to explore the micro foundations of knowledge creation. Past studies have shown that knowledge creation requires a consistent access to and input from a diverse set of resources (Allen & Cohen 1969; Burt, 2004; Freeman 1991; Kogut & Zander, 1992; Powell et al., 1996). Interpersonal exchanges between R&D scientists have been shown to be an important mechanism for the acquisition of needed resources. These exchanges, oftentimes because of their personalized nature, can even transcend divisional and organizational boundaries (see Allen 1977; Allen & Cohen, 1969; Bouty, 2000; Kreiner & Schultz 1993; Von Hippel 1987; Dahl & Pedersen, 2004; or the communities-of-practice literature Wenger & Snyder 2000; Wenger 1998; Brown & Duguid 1991, 2001). Scientists who know one another, belong to the same networks (e.g. communities of practice), can activate their own and each other's networks in order to secure resources and/or validate findings (*ibid*). In part these exchanges are purely interpersonal (Allen & Cohen, 1969; Bouty, 2000; Kreiner & Schultz 1993) and

embedded within ongoing social relations (Granovetter, 1973; 1985). Aiming to acquire a more in-depth understanding of knowledge sharing, the initial stage of this study sought to explore the nature of exchanges between R&D scientists by means of an in-depth qualitative approach. Given the subject matter and the exploratory nature of the research aims at this stage data were collected through interviews with 38 researchers in the Netherlands. Goal of this first part of the study was to acquire a more in-depth understanding of mechanisms and contexts individual actors make use of and are faced with in order to be effective in a R&D context.

Interviews yielded a number of key observations on knowledge sharing between R&D scientists. The interviews conducted for this research suggest that scientists share knowledge and resources in wide range of situations. Furthermore, sharing is indeed not limited to information and ideas, transactions include a diverse set of services as well (e.g. verifying results, use of equipment and utilizing network connections).

Where intra-organizational exchanges are generally considered as appropriate and 'the right thing to do', knowledge is also shared across organizational boundaries. Important considerations for sharing seem to be time constraints, level of involvement, type of relationship and, especially when dealing with an inter-organizational context, confidentiality. Scientists, although to a varying extent, cultivate, maintain and utilize a personal network (see box 1, section 2) ranging from connections such as direct colleagues, colleagues from other departments, fellow researchers met at conferences, contacts from former employers and contacts going back all the way to university[53]. Whenever networks are activated to share information or perform services, the mechanism underlying exchange becomes relevant and apparent.

Reciprocity, the interplay between give and take, plays an important role, where refusal to reciprocate can severely hinder future exchanges (see box 1, section 1). The level of trust and familiarity to a large extent determines willingness and the type of information/ resources available for exchange. Confidentiality issues (see box 1, section 3) feed into these decisions however the decision to exchange in these circumstances is not a black and white issue. The playing field consists of shades of grey and exchangeability is a concept that is not to be approached mechanistically but rather fluid as it depends on person, context, associated confidentiality etc. To use Granovetter's (1985) terminology relationships are embedded and exchangeability is moderated to some extent by type of relationship and level of trust. For that reason relational atrophy was reported to be an issue, as ties which are not maintained over time become more difficult to activate.

53 The notion that ties from former settings persist and play an important role in research also became apparent in a study by Agrawal, Cockburn & McHale (2003) which tracked patent citations and found that former colleagues continued to cite each others work. Agrawal et al. (2003) conclude: 'In effect, geographical proximity works to overcome social distance and, once relationships are established individuals can remain socially close when they become geographically separated'.

Box 6-1 Excerpts on the Topic of Knowledge Exchange

Researchers' views on the topic of knowledge exchange, networks, confidentiality and reciprocity
1. Reciprocity
• "You always look to balance; what can you give and what can you get back." • "There needs to be a win-win situation for both parties involved. Some parties only ask and you know you will never get anything in return." • "In my experience, you need to give if you want to receive. If you give little you receive little." • "Honesty and candor are essential for knowledge exchange. It is all about give and take."
2. Informal network
• "My personal/informal network contacts are important. I have contacts from university and a former employer I regularly contact and which contact me." • "Personal/informal contacts can be faster; especially when they have knowledge that is not available within the company or when it might be available but it is difficult [for example when you don't know the person who might have the particular information]. • "My network is very important for me [in the context of work effectiveness]" • "The [information] requirement is leading, but when you have a choice you opt for the person you have a good relationship with." • "They [close contacts] are very relevant for my work. I use it [my network] to confirm results, access knowledge and speed up my research."
3. Confidentiality issues
• "When I contact personal/external contacts and the issue is confidential; you tell them don't trade this around. Trust and a personal relationship is important. You always make a trade-off between the information you need and confidentiality issues." • "Confidentiality makes it sometimes difficult to gauge why you don't receive pertinent feedback during a scientific discussing. You don't know if the lack of feedback is the result of the fact that they are not willing or because they are not allowed. I usually point out when things become confidential so that people don't doubt my willingness." • "There aren't really hard [specific] rules with regard to what you can exchange and what you can't. In case of doubt I discuss the issue with my manager."

Prevalence of interpersonal exchange among researchers make the topic difficult to dismiss. Although difficult for companies to get a grip on, as became apparent from interviews with managers (e.g. evidenced by the lack of debate and company guidelines about what can and cannot be exchanged), interpersonal exchange plays an important role in knowledge creation. The lack of debate in organizations is notable considering that whenever individuals engage in gift exchange and the give and take this process invariably entails, as its threefold obligation (e.g. to give, receive and reciprocate (Mauss, 1954)) implies, the potential for intellectual capital leaks exists. When asked 77.8 percent of researchers surveyed reported that interpersonal exchanges were important (e.g. strongly agree to agree[54]) for their research effectiveness[55], further underscoring the relevance of exchange for R&D. Indeed, this observation is in line with what other studies have reported (see Allen 1977; Bouty, 2000; Dahl & Petersen, 2004; Kreiner & Schultz 1993; Von Hippel 1987). Few studies, however, have tried to link exchange to actual innovation performance, where the question if it really

54 Breakdown of the results: strongly agree (26.55%), agree (51.33%), neutral (16.37%), disagree (4.42%), strongly disagree (1.33%).

55 Exact phrasing of the question: 'When confronted with a bottleneck in my research, favors rendered via my informal network significantly enhance my research effectiveness'.

makes a differences in terms of bottom line performance might be regarded as the most relevant by most. Addressing these questions, requires us to proceed to the second, and largely quantitative, part of this study, where we will explore the impact of network and exchange orientation on innovation performance.

6.2.2 Network data

Using a standard survey method incorporating name generators and interpreters (e.g. Marsden, 1990; 2004) data was gathered in two Dutch R&D labs. For the analysis, we collected relational (dyadic level data) and non-relational attributes. The set of resulting variables were described in the preceding chapter, Box 6-2 in appendix A provides a succinct overview of used variables. The survey captured virtually the entire research population as 226 of the 232 surveyed researchers[56] completed the network questionnaire. The respondents were involved in 1334 relationships[57] translating into an average of 6,1 contacts per respondents. Two types of possible relationships between two respondents were distinguished; 1) one person cited the other as someone from whom one regularly sought (research related) information and advice, 2) both cited each other as someone from whom one regularly sought research related information and advice. Put differently, both types of relationships, corroborated as well as uncorroborated, were important to this study and in either case a tie is said to exist between two actors. As such, we used in-degree ties to assess ego-networks, allowing us to ascertaining the number of sources that send information or resources to the focal actor. The presence of asymmetric relationships, representing non-reciprocated ties, is to be expected between prominent and less prominent network actors[58]. In fact, these asymmetries represent important cues regarding the position an actor inhabits within the network and as such are considered relevant for this study. Moreover, the use of in-degree networks is consistent with the specific survey method applied[59], as it allowed us to assess the network position of individuals based on the assessment of alters.

The socionetwork, using survey data for company Y, is depicted in Figure 6-1. The socio-gram displays 186 research members (represented by nodes) with lines indicating research related information and advice exchanges between actors
(798 relationships[60]). Not depicted in this figure are the social isolates (6), which represent

56 Breakdown of response rate per company: Company X: 37 (100% response rate), Company Y: 195 (189 out of 195/ 97% response rate).

57 The research population reported a total of 1334 relationships at different levels of intensity (relationships broken down per company; company X represented 223 relationships and company Y 1111 relationships).

58 Knoke and Burt (1983: 199) point out that in network research: “Prominent leaders are the object of extensive relations from followers, while the latter are the objects of few relations.

59 The name generator allowed the respondents to enter a maximum of 14 network contacts, use of the in-degree of the point enabled us to go beyond fixed network size and assess a focal actors relative importance.

60 Company Y provided a total number of 1111 relationships, for the purpose of the socio-gram all relationships which represented frequent (e.g. defined as daily or weekly) interactions were selected representing 798 relationships.

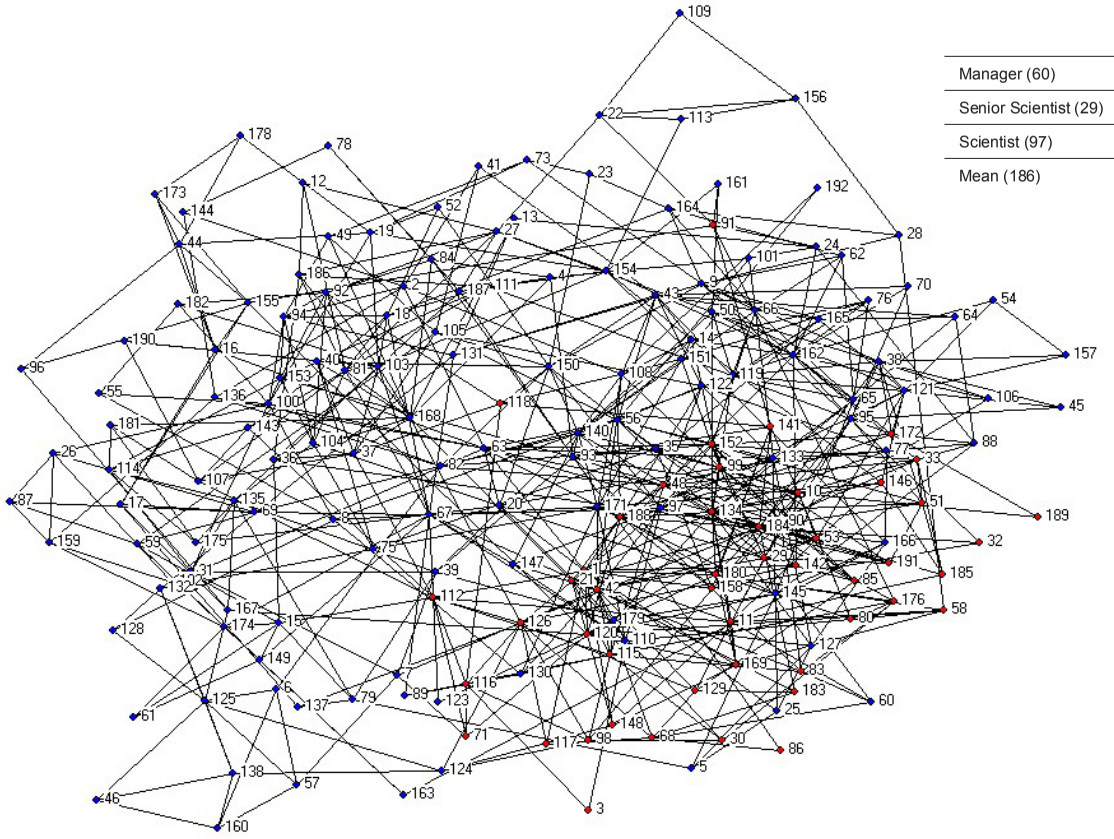
less connected individuals who would be represented by disconnected nodes dispersed in the periphery of the network.

From a network perspective, Figure 6-1 provides us with an overview of the total network configurations or a social map of sorts of the research lab. Research activities in company Y, due to divisional boundaries, were divided between two different organizational departments. The socio-gram incorporates these boundaries utilizing red and blue nodes to represent the different researchers. Using Multi-Dimensional Scaling techniques, nodes that were 'more similar' are positioned closer together. Similarity in this context is based on the actors citing one another and the extent to which they shared the same alters. The clustering of red and blue nodes indicates the presence of some type of boundary between two organizational sub-units.

Table 6-1 Illustrative Network Positions Averaged per Job Grade

	Mean Network Size	Two Step Reach	Normalized Brokerage	Mean Path Distance (Min- Max) for the 186 connected respondents in the graph.
Manager (60)	12,7	50,7	0,4	2,6 (1,9-4,0)
Senior Scientist (29)	10,1	44,2	0,38	2,8 (2,2-4,0)
Scientist (97)	6,8	33,9	0,36	3,0 (2,0-6,1)
Mean (186)	9,8	41	0,37	2,8 (1,9-6,1)

Figure 6-1 Knowledge Exchange Networks (excluding social isolates)



Network measures as presented in Table 6-1 represent a different way of looking at the network depicted visually in Figure 6-1. The actors and relationships they entertain are investigated further by categorizing actors by job grades and relating these to the corresponding network (position) measures. Essentially, these measures enable us to zoom in one more step as they quantify differences in network positions actors, categorized by job grade, inhabit in the social context in which they are embedded. Informative to a high degree, the network measures employed allow us to consider the implications of network position in terms of opportunities and constraints.

The first column of Table 6-1 shows that the size (# indegree ties) of scientist' *Networks* were on average substantially smaller than those of senior scientists and managers. While scientists had networks averaging 6,37 contacts, a senior scientist's average network consisted of 10,05 contacts, only to be surpassed by an average of 12.69 contacts for managers. Networks size or indegree centrality can also be used to determine an actor's centrality within a given overall network. As such, it provides a straightforward and effective, but by no means the only, measure of an actor's centrality. Having many ties is considered beneficial in terms of access to resources and deal maker opportunities.

Column two of the table provides a *Two-Step-Measure* for the different job grades. The measure reports the percentage of actors a focal actor can reach within two directed steps of ego (that is, friends of friends). As becomes clear from the table, scientist are on average able to reach 33,94 percent of the entire network increasing to 44,17 and 50,7 percent for senior scientists and managers respectively. Two-Step-Reach is influenced directly through network size (more contacts, more indirect contacts) and indirectly through the network size of a focal actor's alters. Having more central contacts enables a focal actor to access a larger part of the network without having to incur the costs in terms of network maintenance.

The table's third column considers the *Normalized Brokerage Measure*. Brokerage considers the number of pairs which are not directly connected, creating an opportunity to act as a broker between these two unconnected alters. As such structural holes (cf. non-redundancy) (Burt, 1992) are considered to facilitate access to diverse sources of information offering actors access to more timely and relevant information about upcoming opportunities and complications or contingencies. The table indicates that higher job grades are associated with more brokerage opportunities, even when we take into account the associated larger networks[61].

In the final column of the table, *Average Geodesic Path Distances* are considered. Using the path distance measure the minimum number of relations required to connect alters are determined. Average path distance is calculated for each actor, resulting in the mean geodesic distance for a respondent which captures an actor's closeness to all other nodes in the network. In case of a direct contact between two individuals the distance is one, a connection that takes two directed steps (friends of friends) is two etc. As network density increases the path distances will generally become smaller and vice versa (Hanneman &

61 Note that the Nbrokerage index represents a normalized measure meaning that it accounts for the notion that larger networks have more opportunity to broker. Thus, a normalized index allows us to interpret the results net from network size effects.

Riddle, 2005). Results for the knowledge exchange network in Figure 6-1 show that the diameter of the network (largest path distance) is 6 steps with an average of 2.8 steps. Job grades are associated with different average path distances. Results show that more senior people on average have lower path distances across the network (mean path distances vary from 2,58 to 2,77 and 2,97 for managers, senior scientists and scientists respectively). The best connected actor could reach every other actor in the network in 1,87 steps (that is, within one connection past their direct network contacts (that is friends of friends)), whereas the worst connected actor needed 6,05 bridging relations to accomplish the same feat. Results indicating that a higher job rank is related to shorter paths are not surprising if one considers seniority was associated with larger networks[62] (mean path distance is correlated -.74 ($p<0.01$) with mean network size in figure 2).

6.2.3 Individual networks

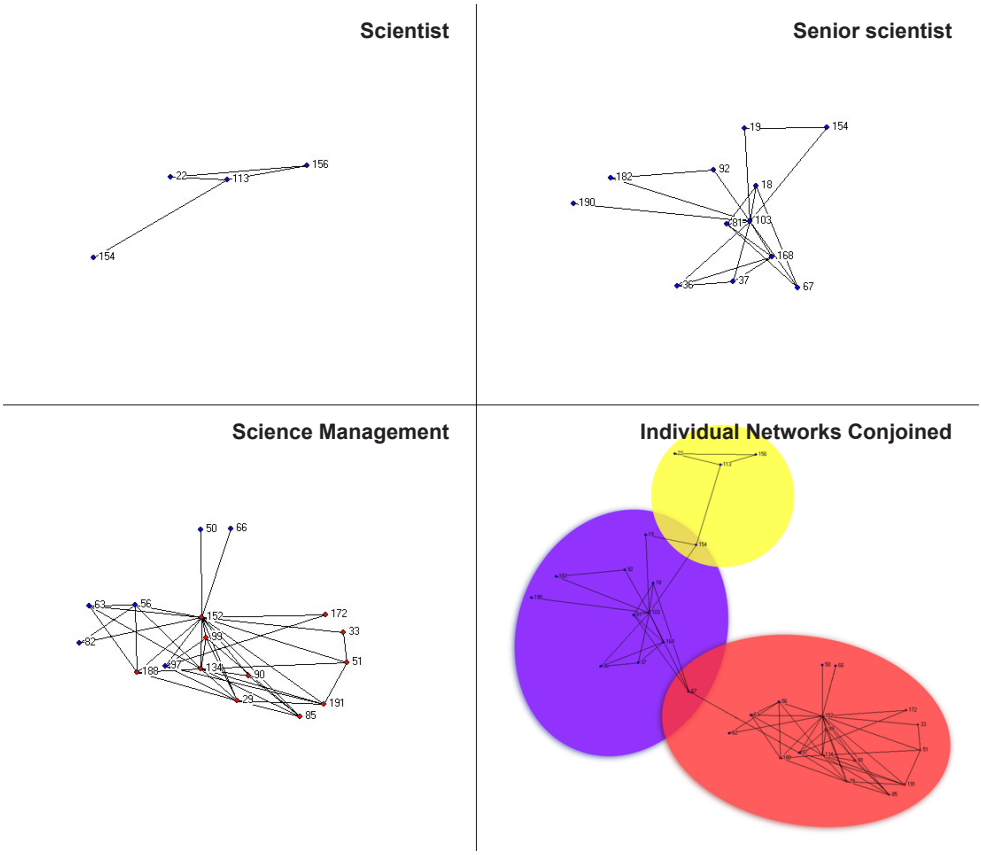
Looking at the overall network in terms of job grades, differences in overall network configuration became apparent. In this setting job grade represents a significant level of aggregation, as such a close up of an individual network within each job grade can be informative. In Figure 6-2 a stylized example of three ego networks[63] is depicted. The knowledge exchange networks presented in Figure 6-1 essentially consists of various interconnected ego networks, three of which, taken from the network's upper right corner, were isolated and depicted in the figure on the next page (Figure 6-2).

Scientist 113's network consists of three connections within the same business unit R&D department (indicated by the blue node). The impact of structural attributes on innovation performance represents an important and recurrent theme within this study. For this particular scientist, subjective performance as rated by his or her supervisor indicates that creativity and implementation skills are above average (4 and 5 respectively), although this has not (yet) translated into objective performance outcomes (# of patents, # of published scientific articles). The implementation score also reflects the importance of implementation for the corresponding job description. Node 103 illustrates a Senior Scientist's network, a network (11 alters) which is substantially larger than node 113's network and spans several sections within the same business unit R&D department. While subjective performance for creativity and implementation as rated by a supervisor is lower (2 and 3 respectively), objective performance is significant (5 or more patent applications). Comparing both scientist and senior scientist to node 152, representative of the job grade (science) manager, the size and breadth of the network immediately stand out. The network spans different sections as well as both business unit R&D departments (as indicated by the blue and red nodes). Moreover,

62 At the same time, job grade is positively associated with organizational tenure a different, yet in terms of explanatory power, related variable providing a (partial) explanation for the observed relationship between senority and larger average networks.

63 Ego networks consist of a focal node ("ego") and the nodes to whom ego is directly connected to (these are called "alters") plus the ties, if any, among the alters (http://www.analytictech.com/networks/egonet.htm.).

Figure 6-2 Illustrative Ego Networks



many of the network contacts hold central positions within the overall network, providing ego with an even larger indirect (two-step) network. In terms of performance, objective and subjective performance are well above average (Creativity: 5, number of patents applied for > 5, and scientific articles published > 5). A score of 2 on implementation performance reflects a job description where implementation is no longer as important a part of daily activities.

These examples provide at least a taste of differences in network size (in-degree centrality), network embeddedness and innovation performance for different job grades. Ascertaining if initial observations based on three different nodes hold any merit requires us to consider different methods of analysis.

6.3 Quantitative Analysis and Hypotheses

Socio-metric techniques provided an overview of the structure of the communication

networks in a research setting. Taking job grade as a point of departure, as we considered scientists, senior scientists and managers (average and individual) networks, differences in network position became apparent. Essentially, the next sections will zoom in further and combine structural network and exchange variables to obtain a deeper understanding of the process as well as its outcomes. This translates into questions such as; what does a different network position imply for researcher effectiveness? What is the role of favor exchange in the transfer of knowledge between researchers in R&D labs? Questions such as these reveal a number of expectations on the part of the researcher. This section will, revisit our conceptual framework and formalize our expectations by means of a set of propositions.

Figure 6-3 visualizes the relationships between the independent and dependents variables of this study, as announced in chapter 1 and substantiated in chapters 2,3 and 4. The constructs and their measures have been explained in chapter 5. Consequently, the relationships between the variables as well as a priori expectations will be discussed here in particular.

This thesis specifically investigates the effect of gift exchange on both economic and social outcomes as elucidated by literature (Belk, 1979; Larsen and Watson, 2001; Cheal, 1996). Accordingly, the propositions as well as the corresponding empirical sections are categorized and structured according to the economic and social properties of gift exchange. The next section will discuss and explicate the relationships between the independent and dependents variables in the context of economic and social outcomes, as announced in chapter 1 and substantiated in chapters 2,3 and 4. The constructs and their measures have been explained in chapter 5. Consequently, the relationships between the variables as well as a priori expectations will be discussed here in particular.

6.3.1 Gift exhange and its economic returns: Propositions

Setting out to explore the impact of exchange while specifically acknowledging its 'social properties' (Cohen & Levinthal, 1990; Kogut & Zander, 1992; Moran & Ghosal, 1996; Nahapiet & Ghosal, 1998; Tsai & Ghosal, 1998) this study investigates the economic as well as the social outcomes of exchange. The economic sphere of gift exchange deals perhaps most directly with the ideology of the gift. According to this perspective gift exchange can be regarded as a purely economic exchange between two parties (Larsen and Watson, 2001) as gift exchange enables parties to exchange and secure valued resources believed to provide additional utility. Utility in the context of this study is defined as individual innovation performance. The theoretical rationale being that individual scientists utilize their network and exchange information and resources as they set out to reach their individual and organizational innovation goals.

The Impact of Network Centrality and Favor Exchange incidence on Innovation Performance.
Networks, a set of relations linking actors (people or organizations), objects or events (Knoke & Kuklinski 1982; Scott, 1991; Wasserman & Faust, 1994), are assumed to influence actors'

actions. As has been argued in chapter 4, knowledge is created by individuals (cf. ;Knight, 1967; Nonaka, 1994) and is the outcome of a process that requires relational networks to facilitate the search, exchange and activation of knowledge (Allen, 1977; Tushman, 1977; Tushman & Scanlan, 1981; Rogers, 1995; Coleman, Katz and Menzel 1966). The extent to which individuals can utilze a network as a resource for knowledge creation is closely related to the position of actors in a network (e.g. centrality) as well as the type (e.g. tie strength) and number of ties they maintain (Hansen, 1999; Uzzi, 1997; Reagans & McEvily, 2003; Granovetter, 1973; 1985). As researchers are more embedded in the network they are believed to have access to more information (Burt, 1992) as well as alternative exchange partners (Emerson, 1972). These opportunities to acquire knowledge and resources are believed to be beneficial for achieving research objectives (cf. Allen, 1977; Tushman, 1977; Tushman & Scanlan, 1981).

Proposition 1A. Subjective innovation performance will increase as actors are more centrally located within the network.

Proposition 1B. Objective innovation performance will increase as actors are more centrally located within the network.

The exchange of favors in the social exchange literature has been recognized to play an important role in social relationships between actors. The exchange of gifts represents more than the exchange of economic utilities, they are also social interactions embedded in social structures (Cheal, 1996). It is believed, that as a corollary of the cycle of giving and reciprocating of a resource, obligation, trust and cooperation are generated between the (exchange) parties involved (e.g., Sahlins, 1996; Mauss, 1954; Gouldner, 1960; Uehara, 1990). Relationships then are formed and maintained through the exchange of gifts (Emerson, 1976; Lawler et al., 2000). Indeed, exchange generates the intrinsic (and depending on the social structure extrinsic motivation) to comply with exchange requests. What's more, through the exchange of knowledge giver and receiver learn more about the other developing a common frame of reference thereby facilitating (future) knowledge transfers (Hansen, 1999; Kogut & Zander, 1992; Nooteboom, 1992, 1999). As such the incidence of exchange could be regarded as an important indication of an actor's potential resource pool and access. Resources which, especially in the field of research, are believed to be essential for R&D performance.

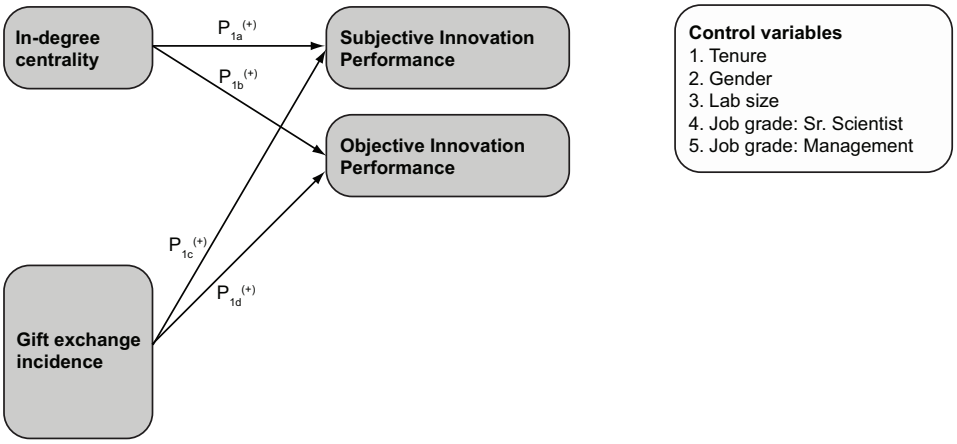
Proposition 1C. Subjective innovation performance will increase as the frequency with which actors exchange favors increases.

Proposition 1D. Objective innovation performance will increase as the frequency with which actors exchange favors increases.

Figure 6-2 visualizes and summarizes the relationships between the independent and

dependents variables with regard to the economic outcomes as explored in this study.

Figure 6-3 Summary of propositions: gift exchange and economic outcomes



6.3.2 Gift exchange and its social returns: Propositions

Exchange, however, is not only an economic transaction, it is also a good in itself, a 'process benefit' that affects the nature of the relationship (Avner, 1997). Gifts are therefore not only transfers of utility but are also social interactions embedded in social structures (Cheal, 1996). The personal relations between giver and receiver are an important dimension of many transactions as they are instrumental in regulating transactions (Rose-Ackerman, 1998). As every gift carries the implicit obligation for the recipient to reciprocate, gift giving creates social indebtedness between people (Belk, 1979; Cheal, 1988; Mauss, 1954; Ruth et al., 1999; Sherry, 1983; McGrath et al., 1996). This indebtedness is what highlights gift giving as an exchange and perpetuates the exchanges process. At the same time indebtedness is regarded as a resource as being perceived as a creditor, rather than as a debtor, increase one's status or reputation as well as one's 'right' to call on the repicient when needed. As such indebtedness (in this study operationalized as 'perceived generosity') can facilitate future action.

The Impact of Brokerage Opportunities, Favor Exchange Incidence and Network Centrality on Perceived Generosity. Network structures and the position actors inhabit within these structures differ. Some are characterized as dense and others as sparse networks, the latter characterized by only a few contacts in a network that have mutual linkages. These structural holes, linkages to groups not otherwise connected, are associated with advantages (Burt, 1992; Baker, 2000; Granovetter, 1973). In fact, structural holes provide opportunity to broker the flow of information. The extent to which an actor can broker between unconnected alters is expected to translate into a positive exchange balance (or higher perceived generosity) for

the focal actor.

Proposition 2A. The extent to which an actor is perceived to be generous will increase as an actor has more brokerage opportunities.

Favor exchange incidence may affect perception of an actor's perceived generosity. Or as Larsen and Watson (2001) phrase it: "Gifts can be described as an investment in the relationship between donor and recipient. The greater the value of the gift, the more substantial the investment". Because gift exchange is generally unbalanced when viewed at one point in time, a longitudinal perspective more accurately reveals the nature of gift giving. A deferred return obligates one individual to another, and therefore creates social debt. At the same time, Belk (1976) has described the tension generated and reduced in unbalanced exchanges as an important dynamic in gift giving (cf. equity theory, Adams, 1965; Deckop et al, 2003; Gouldner, 1960; Maitland, 2002; Walster et al., 1873). The continuing balance of debt – now in the favor of one member, now in the favor of the other – coupled with a certain amount of ambiguity as to whether indebtedness has been repaid over time and the uncertainty it creates about who is in whose debt, insures the relationship between the two actors.

Proposition 2B. Perceived generosity will increase as the frequency with which actors exchange favors increases.

The value of network structures can, according to Burt (1992), be judged on the basis of both information[64] and control benefits. As an actor is more advantageously positioned within the network it is likely that these associated benefits influence an actor's ability to give. In the case of exchange networks bigger is better (Burt, 1992). Ceteris paribus, a large, diverse network is the best guarantee of having a useful contact present. A larger resource base is likely to enable an actor to give and also receive more both in quantitative or qualitative terms. As gift exchange is characterized by a need for reciprocity, balance is an important concept. People are believed to 'maintain loose mental accounts of favor exchange' (Flynn, 2003; p540) by which they judge balance in the exchange relationship. Whenever, one party his given more an imbalance or indebtedness is believed to be present. Thus a deferred return obligates one individual to another, and therefore creates social debt (cf. Bourdieu, 1977; Mauss, 1954; Gouldner, 1960; Adams, 1965; Walster et al., 1973). Social debt and the likelihood of other to inniate and provide an actor with favors are also related to actor status (Merton, 1968), as higher higher status actor have been shown to credited with as well as receive more than those who enjoy a lower status. This leads us to expect that centrally located individuals having access to a larger resource base are likely to entertain relationships where the focal actor is perceived to have given more. As a result of which actors are perceived as generous.

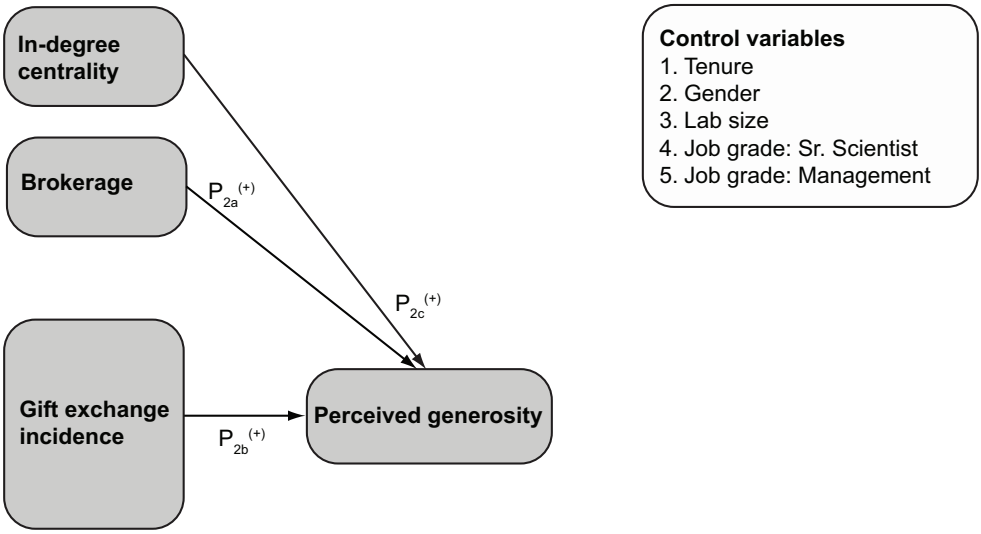
64 Networks facilitate access to broader sources of information at lower cost and information's quality (Laumann & Knoke, 1987), relevance and timeliness (Burt, 1992).

We therefore hypothesize that:

Proposition 2C. The extent to which an actor is perceived to be generous will increase as actors are more centrally located within the network.

The relationships between the independent and dependent variables with respect to the social outcomes are summarized in figure 6-3.

Figure 6-4 Summary of propositions: gift exchange and social outcomes



The following paragraphs will put these propositions to the test as we explore the available ata set. Determinants of innovation performance, as posited by propositions 1A, 1B, 1C, and 1D will be examined in paragraphs 6.4 and 6.5. Lastly, paragraph 6.6 investigates the extent to which propositions 2A, 2B and 2C, which propose a relationship between network position and perceived generosity, are tenable in the face of the available data.

6.4 Network, Exchange and Innovation Performance

Chapters 2,3 and 4 sought to impart the central role individuals, and the structural and relational attributes they command, play in the high stacked game of knowledge creation. In terms of relational attributes, we posited gift exchange's relevance as an effective coordination mechanism that provides economic as well as social benefits (Belk, 1979; Larsen & Watson, 2001). While the social function of gift exchange will be explored in paragraph 6.6, this section explores economic outcomes. As knowledge creation unfolds parties cooperate in

order to secure required resources. To that end they activate both structural and relational attributes (Granovetter, 1992).

Ascertaining the impact of these attributes on innovation performance requires us to define and measure innovation outcomes. In the context of this study, we used both an objective and subjective measure to operationalize performance. In terms of objective data the number of patents applied for by a researcher was used, supervisor assessment of researcher's creativity[65] provided valuable subjective performance data. Note that the latter represents an ongoing evaluation of innovative performance and the former measure represents the sum of a researchers successful (past) patent applications. So whereas creativity rated by a supervisor represents a current performance indicator, patent output reflects to some extent past performance. Thus the use of both measures is likely to provide both a more balanced as well as a more accurate proxy for innovation performance. The hierarchical regression analysis incorporates both measures as the dependent variables allowing us to run several models and explore the impact of structural and exchange variables[66].

In order to avoid bias from other effects on performance, control variables are included. The selected control variables (variables 1 to 5) represent demographic and situational variables which are likely, as demonstrated by previous studies, to affect the dependent variables. These are held constant so as to allow us to study the net effect of this study's main variables. First, organizational tenure was included as individuals who have been with the company longer might have had more time to develop their networks, acquire on-the-job experience, accumulate patents, as well as demonstrate their innovativeness versus recent hires. Second gender in many studies is shown to have some effect. Third, lab size, the number of people working in a lab, is a situational variable that might affect an individual's opportunity to develop networks. Larger networks are likely to offer more possible contacts, visibility and a larger resource base. Fourth, job grade is likely to be important as it presumably conveys skill and past achievements.

Table 6-2 presents the means, standard deviations, and correlations (descriptive statistics) for all the variables analyzed in this study[67]. As noted, the average in-degree centrality (representing network size) was 9.2 contacts and the largest network comprised

65 In terms of performance, researchers were assessed by their immediate supervisors on both creativity and implementation proficiency. Although the later proved to hold little explanatory value it did create a clear cut distinction between the concepts of creativity and implementation.

66 Non-respondent bias, the idea that non-respondents differ from respondents on dimensions which may be linked to the dependent variable and for which one (usually) cannot control, was not considered an issue for this study given the fact that virtually the entire network was surveyed [97 percent response rate].

67 The two related datasets, gathered under similar circumstances and using the same survey instrument, were merged to one dataset. The datasets were generally comparable. Underlying distribution and parameters were assessed; Student's two sample t-test indicated that overall means were comparable. In those cases where differences where found to be present, variables related to the overall network were affected by the number of relationship present in the dataset.

of 42 relations. The average respondent was 43 years of age and had worked 14 years on average for their organization. The average lab size in the organization was 11. Within the dataset twenty-three percent of the respondents were female. The correlation matrix shows that being female is negatively correlated with in-degree centrality, subjective (creativity) and objective (patent output) performance. In line with expectations results show a positive correlation between objective performance and tenure. A management position is positively correlated with in-degree centrality and negatively with exchange frequency. It seems that managers both have larger networks and exchange less knowledge. Finally, both subjective and objective performances are positively correlated with in-degree centrality. As the results of the different regression analyses are considered and interpreted these observations are explored further.

Table 6-2 Means, Standard Deviations and Correlations

Means, Standard Deviations, and Correlations

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9
1. Tenure	14,60	11,32	1								
2. Gender	24,46%	0,43	-,29**	1							
3. Lab size	2,25	0,72	,01	,04	1						
4. Job grade: Sr. Scientist	16,31%	0,37	,06	-,12	,05	1					
5. Job grade: Management	32,19%	0,47	,03	-0,07	-,35**	-,30**	1				
6. Exchange frequency	47,16	43,16	-,17*	,05	-,12	,03	-,18**	1			
7. In-degree centrality	9,20	7,19	,10	-,18**	-,15*	,05	,34**	-,27**	1		
8. Subjective performance	3,39	0,99	-,11	-,17*	-,01	,15*	,06	-,14*	,26**	1	
9. Objecttive output	1,59	1,93	,20**	-,23**	,14*	,16*	,11	-,08	,27**	,14*	1

** Correlation is significant at the .01 level (2-tailed).

* Correlation is significant at the .05 level (2-tailed).

Table 6-3 Results of Hierarchical Regression Analysis Predicting Performance

	Step and Variable	Subjective Performance Model 1	Objective Performance Model 2	Subjective Performance Model 3	Objective Performance Model 4	Subjective Performance Model 5	Objective Performance Model 6
1	Tenure	-0,18**	0,15*	-0,21**	0,15	-0,21**	0,15*
	Gender	-0,17*	-0,15*	-0,17*	-0,15*	-0,15*	-0,13†
	Lab size	0,04	0,22*	0,01	0,22*	0,03	0,24**
	Job grade: Sr. Scientist	0,22**	0,18**	0,21**	0,18**	0,18*	0,15*
	Job grade: Management	0,16*	0,22**	0,19	0,22**	0,05	0,16*
2	Exchange frequency			-0,15*	0,02	-0,10	0,06
3	In-degree centrality					0,21**	0,22**
	R2	0,10	0,15	0,12	0,15	0,15	0,19
	Adj R2	0,08	0,13	0,09	0,13	0,12	0,16
	Overall F	4,04**	7,63**	4,67**	6,34**	5,34**	7,13**
	df	5, 213	5, 215	6, 212	6, 214	7, 211	7, 213

a Entries represent standarized coefficients
† $p \leq .10$
* $p \leq .05$
** $p \leq .01$

In order to evaluate the effect of favor exchange on individual innovativeness we have conducted a hierarchical regression analysis[68] [69] based on ordinary least squares[70]. Table 6-3 presents regression coefficients (betas)[71], absolute value of t-statistics, R-squares[72] and adjusted R-squares. In addition, F-test values for changes in R-square when new variables are included are also reported. Control variables were entered on the first step. Favor exchange frequency was entered on the second step, and number of contacts (network size) was entered on the final step.

Subjective innovation performance [creativity] is the dependent variable in models 1, 3, and 5 while in models 2, 4, and 6 objective innovation performance [patent output] is the dependent variable.

In model 1 we regress the different control variables on subjective performance. Among the controls hierarchical level, gender and tenure are significant for both creativity and patents. Generally, scientists with a higher job grade (reflecting the position in the hierarchy of R&D division) are more creative/innovative whereas job tenure and gender (female) have a negative effect on creativity/innovativeness. Put differently longer tenured employees as well as females are significantly less innovative than recent hires and males respectively. The latter effect may be related to the small overall percentage of women in the sample. Alternatively, status, internal policies and organizational culture might play a role. Incorporation of these controls ensures that impact of favor exchange and in-degree centrality are net of individual and departmental differences which might account for differences in the dependent variable individual innovativeness.

Model 3, in line with proposition 1C, considers the impact of favor exchange on individual innovativeness (as measured by the proxy creativity). Favor exchange is

68 Several tests were conducted to test if regression assumptions were met. In order to examine if the residual terms were uncorrelated (or independent), essentially a form of autocorrelation, a Durbin-Watson test was carried out. Durbin-Watson test statistics indicated that adjacent residuals were not correlated (ranging from 1.8 to 2.0). Sample size was sufficiently large to allow for the use of a t-distribution for tests of significance (Henkel, 1976). Finally, a variance inflation test (VIF) was conducted to test for multi-collinearity (existence of a linear relationship between predictors), results (average VIF: 1,21, largest value: 1,48 for the variable job grade) showed that VIF's were well within limits (Belsley, Kuh & Welsch, 1980) indicating that multi-collinearity did not bias the regression model.

69 Additional analyses not reported here for the de-aggregated datasets were conducted to assess the robustness of results reported in tables 6-2 and 6-3. Models 1 to 8 were regressed on the dataset for company Y (Sample size for company X was not large enough to allow for the use of a t-distribution for tests of significance), the set of regression coefficients (betas) and levels of significance offered similar overall results.

70 Additional analyses were conducted using an ordered logit model to asses the relationship between the explanatory variables and the dependent variables, which allows for estimation of the relationship when a variable is categorical and ordered. The OLS regression model however provided littleexplanatory power.

71 The regression coefficients (betas) provide insight in the influence of individual independent variables on the dependent variable, where the independent variable with the highest beta-value has the largest influence on the outcome variable innovativeness (dependent).

72 The R-square gives an indication of the explanatory value of the independent variables on the dependent variable innovativeness.

negatively and significantly related to individual innovativeness (B= -.147, p< .05) a result which runs to counter to our predicted positive relationship. This counter intuitive finding suggests that as the average gift exchange frequency within an ego-network increases individual innovativeness decreases[73]. The finding seems to contrast Flynn's (2003) finding that favor exchange increases productivity within a network of professional engineers.

Model 5 includes in-degree centrality (a measure which reflects network size) and considers its effect on subjective innovation performance (creativity). The effect of in-degree centrality is positive and significant (B= .206, p< .01) and as such supports proposition 1A. The results suggest that a larger network with more exchange partners positively contributes to individual innovativeness. To the extent that an individual's (in-degree) centrality increases and the individual is connected to more alters their access to resources and new and novel ideas increases (Burt, 2004; Granovetter, 1973). Interestingly, once in-degree centrality has been included the impact of favor exchange on individual innovativeness diminishes and becomes statically in-significant, which seems to suggest that the structural network measures capture a number of effects, including favor exchange. Network measures have been recognized to capture, and as such have been used as proxies for, different effects such as social capital, actor status, informational advantages etc. (Gabbay & Zuckerman, 1998; Galunic & Moran, 2000; Hansen, 1999; Landry et al., 2002; Allen & Cohen, 1969; Allen, 1977; Tushman, 1978; Tushman & Scalan, 1981; Burt, 1992, 2001, 2004).

The relationship with objective innovation performance [as measured by the number of patents applied for] is the focus of models 2, 4, 6 and 8.

Model 2 provides an overview of the effect of the controls on patent output. In contrast to Model 1 which had subjective innovation performance [e.g. creativity] as the dependent variable, tenure is positively related to patent output, that is longer tenured employees on average have a higher patent output. This result is in line with expectations since patent output measures the number of patents applied for by employees over time, as the value represents the sum it is expected to increase. While unit size was not significant when we considered creativity, it is significant and positively related to patent output. Including unit size or the number of people working in each department allows us to account for contextual factors which influence individuals' patent output. The variables job grade (hierarchical level) and gender were significant and negatively and positively related respectively to the dependent variable.

Favor exchange frequency is entered in model 4; results reveal that the effect of favor exchange frequency on patent output has a small positive yet insignificant effect. Based on these results we have to reject proposition 1D. This counterintuitive result is in line with model 3 and will be explored further in paragraph 6.5.

Model 6 adds the predictor in-degree centrality, which is positively and significantly related

73 We also tested for a curvilinear (inverted U-shaped) relationship between gift exchange frequency and creativity, which would suggest that an increase in favor exchange frequency is beneficial up to a certain point (Flynn, 2003). Results however were not significant (p>0.1).

to patent output (B= .22, p< .01).This result corroborates the findings in model 3 and supports proposition 1B, having a greater network provides benefits both in terms of subjective [e.g. creativity] and objective [e.g. patent output] performance. In sum, while gift exchange frequency matters for subjective performance [creativity] its effect is at first glance puzzling. Furthermore favor exchange frequency falls from significance when the structural network property 'in-degree centrality' is introduced. In order to explore these results further the following paragraphs will look closer at the relationships between exchange behavior and innovation.

A comparison between the subjective and objective performance models highlights differences in observed relationships between independent and dependent variables in the two models. First, when considering subjective performance, the extent to which a researcher is rated as creative, organizational tenure is negatively related to creativity (B= -.18, p< .01).

This result seems to suggest that as researchers work longer for the organization their creativity decreases[74]. However, when the simultaneous effect of job grade is considered, the relationships show that a higher job grade is related to higher creativity performance (B= .22, p< .01; B = .16, p< .05). The simultaneous presence of both effects might suggest the existence of an up or out selection process, be it by design or unintended, promoting successful, that is innovative, researchers to higher job grades.
Examination of the objective performance model (e.g. model 2), shows that tenure is positively related to objective performance (patent output). A result which is in line with prior expectation and is closely related to the performance variable as it is based on patent output. As tenure increases so does the likelihood that, based on the research one has undertaken, one has applied for patents. Again, job grade is positively related to performance (B= .18 p< .01; B = .22, p< .01) a result which seems to reflect the promotion of successful researchers. Second, the variable 'lab size', reflecting the number of researcher working for a department, shows markedly different results for both performance models. Where lab size has no significant effect (B= .04, p > .05) on subjective performance (e.g. creativity) it does positively influence researchers' patent output (B= .22, p < .01). The larger resource base larger departments have at their disposal seemed to be an important facilitator. Of course, larger departments due to their size and manpower have more ongoing research projects at any given moment than smaller departments. A larger project base provides an increased opportunity that patentable results arise. Finally, differences in the impact of the main dependent variable become apparent when considering both models examining subjective and objective performance simultaneously. Gift exchange, capturing in economic terms the frequency with which an actor exchanges information and knowledge, negatively impacts subjective performance (B= -.15, p < .05) but does not affect objective performance

74 Additional analyses not reported here found an interaction effect between tenure and job grade Senior Scientist (B = -.242, P<.05) indicating that longer tenured senior scientists also are reported to be less creative.

(B= .02, p > .05). Moreover, a researcher's in-degree centrality (indication for size of ego network) positively impacts both subjective and objective performance (B= .21 p< .01; B = .22, p< .01) which at the very least seems to underscore the important role that networks and cooperation play in research. Of course, one cannot rule out the possibility that the causality runs in the opposite direction. That is, successful scientists are contacted more frequently by other researchers and find it easier to maintain larger networks. Though the study did control for tenure, job grade is likely to be associated with scientist performance as such we cannot completely rule out this possibility. Nonetheless, the importance of networks and cooperation for productivity in science is undisputed (cf. de Solla Price & Beaver, 1966; Zuckerman, 1979).

The following paragraphs will take the results from this section as a basis for further exploration. These paragraphs will introduce additional analyses and variables, with the aim of providing a more in-depth analysis.

6.5 Favor exchange and innovation performance

The regression analyses conducted in the last paragraph revealed that favor exchange incidence and innovativeness are significant though negatively related. This finding seems to be contrary to prior research (Flynn, 2003), which showed that favor exchange frequency and productivity were positively related. More specifically the study carried out by Flynn (2003) looked at the individual productivity of professional engineers working in the telecommunication branch. Productivity was measured by looking at proxies such as: number of jobs completed, number of specs drafted, number of hours logged and the number of technical drawings produced. Theoretically the positive benefits of frequent favor exchange are attributed to an increased efficiency of exchange of resources as well as the particular benefits (e.g. access to resources, more flexibility in handling problems of varying size) the exchange offers (Flynn, 2003; Molm & Cook, 1995).

A case can thus be made for a positive relationship between innovativeness and favor exchange frequency, along the lines of Flynn's research. The argument would be that as researchers on average engage more frequently into exchange with relevant others, they have more resources, knowledge and pertinent ideas at their disposal contributing to their individual innovativeness. Though reasonable the results clearly don't support this argument. To understand why, we need to consider the difference between productivity and innovation outcomes. This study focuses on the benefits of favor exchange for innovation related outcomes. As has been discussed, knowledge, the basis of innovation, has properties that set it apart from other more tangible outcomes. The focus here is on the cumulative nature of knowledge, that is the idea that knowledge creation depends on the combination and recombination of existing knowledge (Moran & Ghosal, 1996; Nahapiet & Ghosal, 1998; Tsai & Ghosal, 1998). Combining knowledge requires actors to access and exchange knowledge the structural attributes for which are provided by professional networks.

Networks are important because individuals rely to a considerable extent, especially in knowledge-intensive settings, on their networks of relationships in order to solve problems and find the required knowledge or information (Cross et al., 2002; Park 2002; Dougherty and Hardy, 1996; Rogers, 1995; Coleman, Katz, and Menzel, 1966). Who one knows affects one's ability to obtain required information (Burt, 1992; Granovetter, 1973). Our analysis corroborated the predictive value of in-degree centrality of individual innovativeness both in terms of creativity and patents output.

Correlation coefficients, means and standard deviations for in-degree centrality, exchange frequency and tie strength are displayed in Table 6-4 The descriptives show that exchange frequency differs across respondents. At the same time, in-degree centrality results between respondents display markedly different network sizes (min.: 1 tie, max.: 42 ties) as well. Such differences between ego-networks may affect network dynamics as well as outcomes.

Table 6-4 Means, Standard Deviations, and Correlations

	Means, Standard Deviations, and Correlations					
Variable	**Mean**	**s.d.**	**1**	**2**	**3**	**4**
1. In-degree centrality	9,20	7,19	1			
2. Exchange frequency	47,16	43,16	-,27**	1		
3. Tie strength	0,13	0,08	-,30**	,28**	1	

** Correlation is significant at the .01 level (2-tailed).

* Correlation is significant at the .05 level (2-tailed).

The correlation matrix reveals that favor exchange frequency is negatively associated with in-degree centrality (cf. Table 6-4) meaning that as an ego network becomes larger average favor exchange frequency decreases. An explanation for the observed decrease in favor exchange frequency is likely to have to consider the notion that individuals are constrained in terms of time and energy. As in-degree centrality increases, that is the number of ties an individual entertains, the average [exchange] interaction is likely to diminish. Likewise, Granovetter (1973) and Burt (1992) argue that building strong ties involves a larger commitment in time and energy. This conceptualization of tie strength is adopted in this study in that tie strength is defined as a combination of the amount of time spend and the emotional intensity involved. Table 6-4 shows that, in line with prior research, the average tie strength in our research population decreases as an ego's in-degree centrality increases.

The results, which indicate that in-degree centrality (network size) is positively related to individual innovativeness and larger networks on average are made up of weaker ties [as well as lower favor exchange frequencies], beckon the question why weak ties are more

conducive to individual innovativeness than strong ties? The strength-of-ties literature has looked extensively at the nature of relational bonds and the effects on information sharing (e.g. Frenzen & Nakamoto, 1993; Granovetter, 1973; Hanssen, 1999; Uzzi, 1999). In terms of information sharing strong ties are associated with an increased likelihood that actors will share complex as well as sensitive information, whereas weak ties afford access to a greater and more diverse knowledge potential (Frenzen & Nakamoto, 1993; Hanssen, 1999). Granovetter (1973) introduced the notion that weak ties provide access to non-redundant information and facilitates knowledge diffusion. Frenzen and Nakamoto (1993;p.373) emphasize weak ties' ability to bridge since, there is a "structural tendency for strong ties to cluster in dense, island-like cliques and weak ties to scatter widely as non-redundant bridges that links cliques together". Hansen (1999) concludes that depending on the situation, although strong ties are associated with knowledge (transfer) benefits, weak ties are more conducive to facilitate the search for ideas, new knowledge and solutions.

Weak ties[75] that bridge otherwise disconnected social groups can be more valuable than connections that do not have such a varied set of resources within reach (see also Tsai & Ghosal, 1998; Granovetter,1973). An argument that is also made by Burt (2004) who stresses the importance of bridging disconnected actors for obtaining creative benefits. Innovation then is more likely to be discovered through knowledge brokering (Sutton & Hargadon, 1996).

The ability for individuals to broker is associated, although not synonymous, with network size[76]. As Burt (1992; 2004) emphasizes individuals who are in a position to broker and span structural holes have a greater exposure to alternative perspectives, good ideas, opportunities and so forth translating into what he dubs 'creative benefits'. The idea that innovation, representing a combination and recombination of existing knowledge, benefits from better access to knowledge and ideas ties is reflected by our results (See also table 6-3: subjective performance: $B=.21$, $p<.01$ and objective performance $B=.22$, $p<.01$). Objective and subjective performance both are positively associated with a higher in-degree centrality.

The benefits offered by weak ties for innovation related outcomes are not reflected for implementation performance[77]. This seems to indicate that individual implementation performance does not benefit to the same extent from the informational advantages offered by a larger network exposure.

75 Closely related to the idea that weak ties provide access to non-redundant information is the notion that they are less costly to maintain allowing ego to maintain a larger network.

76 A larger network is likely to provide more brokerage potential, that is bridging unconnected network pairs, however this is not to say that larger networks necessarily equate with the ability to broker it all depends on the structure of the network.

77 Additional analyses not included indicated that both in-degree centrality and favor exchange frequency were not statistically significant predictors of implementation performance.

6.6 Perceived generosity and network position

The relationship between exchange and innovation related outcomes, as explored in the last two paragraphs, provided a singular focus on economic outcomes of exchange. However, as Avner (1997) points out, exchange is more than just an economic transaction as its effect extents beyond the economic into the social by affecting the relationship between the parties involved (cf. Belk, 1979; Larsen & Watson, 2001). Although personal relations between giver and receiver represent an important dimension in many transaction (Rose-Ackerman, 1998), their instrumental functions in regulating transactions should not be overlooked. Given our focus on reciprocal forms of exchange, where actors separately contribute and reciprocity is generally deferred, indebtedness between exchange partners represents an important variable. Whenever actors are not able to (sufficiently) reciprocate received benefits (e.g. perceive that they have received more than they have provided) exchange theory posits that actors incur social debts. Indebtedness then represents the extent to which the giver can call on the recipient for future benefits (Mauss, 1954; Bourdieu, 1977; Ferrary, 2003; Deckop et al., 2003; Coleman, 1988).

The equality or inequality of the exchange relations, representing the basis for indebtedness, were measured by asking respondents to indicate with regard to their exchange partners who had given more. Combining these results with network data and individual control variables allows us to explore the effect of the aforementioned variables on perceived generosity (e.g. the extent to which a focal actor was considered generous). Correlations among variables presented in these models are reported in Table 6-5. As discussed in the previous paragraphs job grade management is positively correlated with in-degree centrality. These results also show a positive relationship between management and the opportunity to broker. The opportunity to act as a go-between, as becomes clear from the correlation matrix, is positively associated with tenure. At the same time brokerage is positively correlated with perceived generosity. This outcome will be explored further when we discuss our regression results. Table 6-6 presents results based on linear multiple regression based on random permutations. Control variables were entered in the first step. Brokerage was entered on the second step, and the variable 'in-degree centrality' was entered in the final step.

The dependent variable in models 1-3 is perceived generosity.

Model 1 represents the base model and includes the control variables gender, tenure, lab size and hierarchical level. Contrary to expectation the variables job tenure and hierarchical level (as well as gender) were not significant predictors of perceived generosity. In line with previous research (Goffman, 1971; Buunk, Doosje and Hopstaken, 1993, Merton, 1968; Homans, 1950; Bodeman, 1988) it was expected that hierarchical status would influence the dependent variable perceived reciprocity. For example Buunk, Doosje and Hopstaken (1993) found that although employees indicated that their exchange relationships with colleagues were reciprocal, exchange relationships with supervisors were not balanced, more specifically they felt the exchange over-benefited them (e.g. they had

Table 6-5 Means, Standard Deviations and Correlations

Means, Standard Deviations, and Correlations

Variable	Mean	s.d.	1	2	3	4	5	6	7	8	9
1. Tenure	14,60	11,32	1								
2. Gender	0,24	0,43	-,29**	1							
3. Lab size	2,25	0,72	,01	,04	1						
4. Job grade: Sr. scientist	0,16	0,37	,06	-,12	,05	1					
5. Job grade: Management	0,32	0,47	,03	-,07	-,35**	-,30**	1				
6. Brokerage	134,19	216,43	,14*	-,11	-,06	,09	,04	1			
7. In-degree centrality	9,20	7,19	,10	-,18**	-,15**	,05	,34**	,22**	1		
8. Exchange frequency	47,16	43,16	-,17*	,05	-,12	,03	-,18**	,10	-,27**	1	
9. Perceived generosity	3,05	0,38	-,05	-,05	,12	-,10	-,09	,20**	-,04	,12	1

** Correlation is significant at the .01 level (2-tailed).

* Correlation is significant at the .05 level (2-tailed).

Table 6-6 Results of Hierarchical Regression Analysis Predicting Perceived Generosity

Means, Standard Deviations, and Correlations

	Step and variable	Model 1	Model 2	Model 3	Model 4
1	Tenure	-0,15	-0,17	-0,20	-0,28
	Gender	0.80	-0,06	-0,04	-0,05
	Lab size	0,15*	-0,13†	0,12†	0,12†
2	Brokerage		0,19**	0,21**	0,22**
3	In-degree centrality			0,27**	0,23**
4	Exchange frequency				0,16*
	R2	0,05	0,09	0,16	0,19
	Adj. R2	0,02	0,06	0,13	0,15
	Overall F	2,102	3,152*	5,086**	5,178**

a Entries represent standarized coefficients
† p ≤ .10
* p ≤ .05
** p ≤ .01

received more from their supervisors than they had given).

The notion of differences in perceived value in relation to higher status actors has also been referred to as the Mathew effect[78] (Merton, 1968) capturing the idea that those who 'have' are credited with/receive more than those who 'have less or have not'. Similarly Homans (1950) points out "the higher a man's social rank, the larger will be the number of persons that originate interaction for him".

Model 2 explores the impact of brokerage on perceived generosity. Brokerage considers an actors opportunity to act as a go-between between alters who are not directly connected. As such the measure considers the extent to which the network position of an actor is beneficial. Brokerage is positively and significantly related to perceived generosity ($B = .19$, $P < .01$) as predicted by proposition 2A. This finding suggests that as actors inhabit network positions that allow them to broker between unconnected alters, the focal actor is perceived to be more generous by his alters.

Model 3 includes in-degree centrality (size of network) and considers its effect on the dependent variable perceived generosity. The effect of in-degree centrality is both positive and significant ($B = .27$, $p < .01$) confirming proposition 2C. The results indicate that as an actor's network increases and he or she is connected to more alters, the focal actor is considered to be more generous.

Model 4 assesses the impact of exchange frequency on perceived generosity. In line with proposition 2B exchange frequency is significantly and positively associated ($B = .16$, $p < .05$) with the extent to which one is considered generous. That is exchanging frequently enables actors to influence perceived social indebtedness, which according to theory facilitates an actor's future access to resources.

The structural network measures added in models 2-3, reflecting differences in the network position of actors, show a marked effect on perceived generosity. At the same time, contrary to theoretical and empirical expectations, hierarchical position did not have a significant impact on perceived generosity. These relationships give us ground to reconsider the notion that differences in hierarichal position impact perceived generosity as put forward by theory[79]. Instead the results indicate that the network position an individual inhabits holds more explanatory power influencing the way alters assess a focal actor's generosity.

78 The Matthew effect refers to the parable of the talents in the gospel of Matthew. Where it says: 'for unto every one that hath shall be given, and he shall have abundance: but from him that hath not shall be taken away even that which he hath' (Matthew 25:29 King James Version).

79 The alternative explanation which posts that hierarchical position (e.g. job grade) does not affect perceived generosity ($B = -.09$, $P > .1$) because of managers' detachment from the actual R&D process and hence their limited ability to prove a valuable exchange partner seems unlikely for two reasons. Firstly, management positions may reduce an individual's ability to provide research related benefits but does put him/her in a position to provide other types of valued benefits. Secondly, job grade senior scientists ($B = -.01$, $P > .1$) representing a group of senior employees very much involved in the R&D process also proved to hold no explanatory power with regard to outcome variable perceived generosity.

Perceived generosity in turn is posited to strengthen an actor's right to call upon an actor to provide resources when needed. Or as Bodemann (1988) points out; (informally) powerful people –being in a position where they can confer benefits to others – will receive more gifts than less powerful individuals, so that they might be more likely to reciprocate the focal agent. These results enable us to consider and take account of informal forms of power as an important predictor of exchange related outcomes.

As suggested by model 4 the impact of exchange frequency on the loose mental accounts, individuals are believed to maintain of prior favor exchange cycles, allowing them to determine the extent to which a giving and receiving is balanced or unbalanced (Flynn, 2003; Clarc, 1984; Clark, Mills & Corcoran, 1989), has interesting implications both from a practical and theoretical perspective. In order to offer an explanation for the interplay between exchange frequency and perceived generosity we draw on exchange literature. People's perceptions of exchange balance are subjective and people maintain loose mental accounts. As such memory biases as well as egocentric biases (Sprecher, 1988; Flynn, 2003) are thought to affect these accounts. Frequent giving does not necessarily equate with large favors and can also and is more likely to reflect numerous smaller gifts. However, as one receives favor more frequently they might be recalled more readily by the recipient. As the specifics of the exchanges are forgotten what might remain is the notion that one has received numerous times. At the same time, literature emphasizes the tension generated by unbalanced exchanges as an important dynamic in gift giving Belk (1976). The value of indebtedness as a determinant of alter's willingness to respond to requests has been stressed before.

Network structure – the size and shape, and connections among actors – imposes limitations on and provides opportunities for exchange. Network structure creates incentives for actors to exchange, influencing 'who is likely to interact and exchange with whom' (Skvoretz & Lovaglia, 1995; Lawler, Thye & Yoon, 2000). To the extent that the actors inhabit more favorable positions (e.g. network centrality, brokerage opportunities) within a network and/or command a larger network, actors will, ceteris paribus, have more resources and alternative exchange partners at their disposal. As such favorable network positions serve as a basis for power differentials between actors (e.g. Emerson, 1972; Blau, 1964) as well as inequalities in exchange outcomes (Cook & Rice, 2003). The effects of network structure and its relationship with perceived generosity lead us to consider two possible explanations. By virtue of their larger networks and increased brokering opportunities actors are able to access a larger resource base allowing them to provide extensive benefits to their alters. As alters are not able to reciprocate to the same extent this results in a relational imbalance in their relationship with the focal actor, affecting perceived generosity. At the same time,

perceived generosity can also be related to the value of the provided resources.

The argument being that as actors command larger networks and have more brokering opportunities their networks extend into more exchange domains[80] (Emerson, 1972) giving them access to different and potentially more valued resources. As a consequence they are able to provide alters not with more but higher valued resources. Within the context of knowledge generation this argument ties in with Burt's (1992; 2004) notion of creative benefits (resulting from an exposure to alternative perspectives, good ideas, opportunities) which he links to structural hole spanning and brokerage opportunities.

At the same time, perceived generosity offers considerable advantages in part brought about by favorable network positions. Whenever actors can maintain one partner's exchange with only intermittent reciprocity, they are in a position to pursue other exchange relations and maintain larger networks and appropriate the associated benefits. Moreover, perceived generosity strengthens an actor's right to call on the partner to provide assistance/resources. Both benefits can bolster an individual's effectiveness as evidenced in earlier paragraphs and might very well reflect a self-reinforcing phenomenon.

80 The concept of an exchange domain is defined as a set of functionally equivalent outcomes, where the receipt of one outcome in the set reduces the value of all outcomes in that specific domain (Emerson, 1972). Applying economic terms would lead us to consider outcomes in the same domain as substitutable and those in different domains as possible complementary (Yamaguchi, 1996).

Model 2 indicates, in line with earlier results, that in-degree centrality effectively reduces the average exchange frequency between any two notes (B = -.23, p< .01). Having a larger network with more alters imposes time and energy constraints on the focal actor meaning that exchange intensity with individual alters is substituted for overall network range. This result runs counter to our initial expectations as formulated in proposition 1D.

Model 3 considers the impact of knowledge heterogeneity on exchange frequency. Knowledge heterogeneity is positively and significantly related to exchange frequency (B = .24, p< .01). That is, exchange frequency significantly increases when exchange partners share a similar knowledge base. Thus, proposition 2A is supported. Similarity in expertise base positively impacts average exchange frequency. As a predictor of exchange frequency this makes sense, in that their shared knowledge base facilitates communication and exchange. At the same time, innovation literature indicates that innovation benefits from the combination of different areas of expertise (Hargadon & Sutton, 1997; Galunic & Rodan, 1998; Rodan & Galunic, 2004). Results show that exchange in such settings, although beneficial, at the same time is less frequent or less likely. As posited by Nooteboom (1992; 1999) the relationship between innovation performance and knowledge heterogeneity is believed to represent a curvilinear relationship. An increase of knowledge heterogeneity is likely to be positive up to point, providing opportunity for novel combination of knowledge, however when actor's knowledge is too different it precludes the mutual understanding needed to reap potential innovation benefits.

Model 4 introduces tie strength and considers its effect on exchange frequency. The effect of tie strength, a variable which reflects both 'closeness' and 'communication frequency', on exchange frequency is positive and significant (B = .17, p< .05). Proposition 2B is supported in that actors exchange more with their alters as tie strength increases. Literature indicates that strong ties facilitate exchange in general and knowledge exchange in particular. As relationships develop and the exchange interactions progresses actors learn to cooperate (Powell et al., 1996, Starpoli, 1998; Galuti, 1995) and establish a common frame of reference allowing actors to incorporate new (tacit) knowledge (Hansen, 1999; Kogut & Zander, 1992; Von Hippel, 1994). During the exchange of knowledge actors also have the opportunity to gauge the expertise and abilities of the exchange partner and develop competence trust (Nooteboom, 2002).

In sum, models 2-4 indicate that the frequency of exchange increases when actors share the same knowledge base and are connected by strong ties. Theoretically these findings make sense as exchange will tend to be easier for actors who have learned to cooperate, developed a shared frame of reference and trust. However, although knowledge exchange between actors may be more efficient, in terms of innovation outcomes the result may be suboptimal. New knowledge generation requires the input and combination of knowledge and ideas preferably from multiple and heterogonous sources. Strong ties and a similar knowledge background increases redundancy and reduces the likelihood of the introduction of disparate ideas or concepts which is likely to hamper creativity. In light of the expected benefits that come from combining and diverse knowledge and actors tendencies to exchange with

actors likely to possess redundant information we should not expect the existing exchange configurations to automatically represent the optimum.

6.7 Discussion

This study considered the impact of structural and relational attributes on innovation and gift exchange outcomes. As such, the study yielded both expected as well as unexpected results.

Table 6-8 summarizes the key finding of this study. Structural attributes and too a lesser extent relational attributes provided cues that contribute to innovation performance. At the same time, structural and relational variables were used to explore the notion of knowledge transfers as gifts.

Table 6-7 Summary of Propositions and Results

Propositions	Description	Hypothesized Relationship	Results
Proposition 1A.	Subjective innovation performance will increase as actors are more centrally located within the network.	+	+
Proposition 1B.	Objective innovation performance will increase as actors are more centrally located within the network.	+	+
Proposition 1C.	Subjective innovation performance will increase as the frequency with which actors exchange favors increases.	+	-
Proposition 1D.	Objective innovation performance will increase as the frequency with which actors exchange favors increases.	+	n.s.
Proposition 2A.	The extent to which an actor is perceived to be generous will increase as an actor has more brokerage opportunities.	+	+
Proposition 2B.	Perceived generosity will increase as the frequency with which actors exchange favors increases.	+	+
Proposition 2C.	The extent to which an actor is perceived to be generous will increase as actors are more centrally located within the network.	+	+

Work in a R&D lab is characterized by regular interpersonal requests for information or resources, and as such considered both an interesting and appropriate venue for this type of research. Indeed, researchers exchange regularly with other R&D scientists, both within and outside their own firm. Conceptualizing knowledge flows as an exchange of gifts, this study, in addition to the impact on innovation related outcomes, also explores the exchange process itself. As such, we investigated determinants of exchange incidence.

As dyadic exchanges are believed to affect actors' (subjective) perception of the exchange balance (Blau, 1964; Flynn, 2003; Clark et al., 1989) this study investigated determinants of perceived generosity. Given network structure's explanatory value in

a variety of settings, this study set out to extend previous research by exploring network structure's effect on perceived generosity. It was believed, that is we expected, that favorable network positioning (e.g. opportunity to broker and in-degree centrality) as well as a frequent exchange between actors would be positively associated with perceived generosity. Where results supported the notion that network position operationalized by means of the variables 'brokerage' and 'in-degree centrality' resulted in actors being credited with a higher perceived generosity, gift exchange incidence held less explanatory value. Therefore, frequency of exchange as a determinant of perceived generosity as demonstrated by Flynn (2003) could not be corroborated. Interestingly network structure (brokerage and network size) proved to explain partly why certain actors are perceived as generous. Thus, the results indicate that as an actor's network increases and he or she is connected to more alters, the focal actor is considered to be more generous. In contrast to previous findings (Goffman, 1971; Buunk, Doosje and Hopstaken, 1993, Merton, 1968; Homans, 1950; Bodeman, 1988) however, hierarchical status did not significantly affect the dependent variable perceived reciprocity. These relationships give us ground to reconsider the notion that differences in hierarchical position has an impact on perceived generosity as put forward by theory. Instead the network position an individual inhabits holds more explanatory power, as it influences the way alters assess a focal actor's generosity. The implication of this finding might very well be that it is not as much an actor's formal position that counts as is his of her (informal) position within the social network.

The first part of this study considered how structural (network) and relational attributes affect individual innovation outcomes. We anticipated a positive association between both network position/gift exchange incidence and individual innovation performance. Findings were supportive with regard to a number of expectations. The study confirmed the notion that a favorable network position operationalized as in-degree centrality is favorable for both subjective [e.g. creativity] and objective performance [e.g. patent output]. The observed effects are explained by considering that as an actor's centrality increases, he or she is more likely to have increased access to both resources as well as new and novel ideas (Burt, 2004; Granovetter, 1973). Indeed, the association between network structure and (innovation related as well as general) performance has been demonstrated in a number of studies (Burt, 2004; Ingram & Roberts, 2000; Reagans & McEvily, 2003; Hanssen, 1999; Uzzi, 1999; Moran, 2005). Contrary to expectation as well as previous studies (cf. Flynn, 2003) favor exchange incidence proved to be significant though negatively related to subjective performance and not associated with objective performance. The negative relationship between favor exchange incidence and subjective performance was not originally hypothesized. However, further investigation suggested an explanation consistent with literature underscoring the importance of weak ties for knowledge creation (cf. (Frenzen & Nakamoto, 1993; Hanssen, 1999; Granovetter, 1973; Burt, 2004). Additional analyses demonstrated network size's positive association with individual innovativeness and larger networks' (on average) higher composition of weaker ties [as well as lower favor exchange frequencies], emphasizing the role of weak ties in knowledge creation. The notion that weak ties are beneficial to knowledge creation rests on weak ties tendency to provide

access to non-redundant information, ideas, knowledge and solutions (Frenzen & Nakamoto, 1993; Hansen, 1999; Burt, 2004). The reduction of the average favor exchange frequency then could be explained by considering that individuals are constrained in terms of time and energy. As in-degree centrality (size of network) increases the average [exchange] interaction is likely to diminish (Granovetter, 1973; Burt, 1992).

An interest in the reality of knowledge transfers between scientists provided the starting point for this study. The idea that know-how transfers essential for innovation are not simply explained by either market of hierarchy represented the starting point. Our findings underscore the importance of structural and relational attributes for innovation and insight in the exchange process itself. Of course, statistical significance is not always synonymous with scientific significance (cf. McCloskey and Ziliak, 1996). However, understanding the theoretical mechanisms underlying interpersonal exchange enables us to explain an important and salient knowledge transfer reality. A reality where scientists continue to exchange knowledge on an informal basis with fellow researchers within as well as outside the firm.

References

Adams, J.S. (1965) 'Inequity in social exchange,' In: *Advances in experimental social psychology*., Ed. Berkowitz, L., New York: Academic Press.

Agrawal, A.K., Cockburn, I.M., & McHale, J. (2003) 'Gone but not forgotten: Labor flows, knowledge spillovers and enduring social capital.' *Working Paper 9950*

Allen, T.J. (1977) *Managing the flow of technology.* Cambridge MA: The MIT Press.

Allen, T.J., & Cohen, S.I. (1969) 'Information flow in research and development laboratories' *Administrative* Science Quarterly 14: 12-19.

Avner, O. (1997) 'Between the Gift and the Market' *The Economic History Review* 50(3): 450-476.

Baker, W. (1990), 'Market networks and cooperate behavior', *American Journal of Sociology*, 24, 589-625

Belk, R. (1979) 'Gift-Giving behavior', In: *Research in Marketing Volume 2*, Ed. Sheth, J., Greenwich, CT:, JAI Press

Belsey, D.A., Kuh, D., & Welsh, R.E. (1980), Regression Diagnostics: Identifying Influential Data and Sources of Collinearity, New York: Wiley

Blau, P.M. (1964) *Exchange and Power in Social Life*. New York: Wiley

Blau, P.M. (1963), The dynamics of bureaucracy: A study of interpersonal exchange in two governmental agencies. Chicago: University of Chicago Press.

Bodemann, Y.M. (1988), 'Relations of Production and Class Rule: The Hidden Basis of Patron-Clientage.',

In: Social Structures: A Network Approach, Eds. Wellmann, B. & Berkowitz, S.D., Cambridge: Cambridge UP.

Borgatti, S.P., Everett, M.G. and Freeman, L.C. 2002. Ucinet for Windows: Software for Social Network Analysis. Harvard, MA: Analytic Technologies.

Bourdieu, P. (1986), 'Forms of Capital', In: Handbook of Theory and Research for the Sociology of Education., Ed.

Richardson, J. G. , New York: Greenwood Press.

Bourdieu, P. (1977) *Outline of a Theory in Practice.* Cambridge UP: Cambridge

Bouty, I., (2000), Interpersonal and interaction influences on informal resource exchange between R&D researchers across organizational boundaries, Academy of Management Journal, 43(1), 50-65

Brown, J.S. & Duguid, P. (1991), 'Organizational Learning and Communities of Practice' *Organization Science,* 2(1): 40-57

Brown, J.S. & Duguid, P. (2001) 'Knowledge and Organization' *Organization Science* 12(2): 198-213.

Burt, R. S. (2004) 'Structural Holes and Good Ideas' *American Journal of Sociology,* 110, 442-455

Burt, R. S. (2001). "Structural Holes versus Network Closure as Social Capital." Pp. 31-56 in Social Capital: Theory and Research, edited by Nan Lin, Karen S. Cook, and Ronald S. Burt. New York: Aldine de Gruyter.

Burt, R.S. (1992) 'Structural holes: The social structure of competition', Cambridge, MA: Harvard UP.

Buunk, B.P., Doosje, B.J., Jans, L.G.J.M., & Hopstaken, L.E.M. (1993), Perceived Reciprocity, Social Support, and Stress at Work: The Role of Exchange and Communal Orientation, *Journal of Personality and Social Psychology*, 65(4), 801-811

Cheal, D. (1986) 'The Social Dimensions of Gift Behaviour' *Journal of Social and Personal Relationships* 3: 423-439

Clark, M.S. (1984), 'Record keeping in two types of relationships', Journal of Personality and Social Psychology, 47, 549-557

Clark, M.S., Mills, J., & Corcoran, D.M. (1989), 'Keeping track of needs and inputs of friends and strangers', *Personality and Social Psychology Bulletin*, 15, 533-542

Cohen, W.M., & Levinthal, D.A. (1989) 'Innovation and learning: The two faces of R&D' *Economic Journal,99,* 569-596

Cohen, W.M., & Levinthal, D.A. (1990) 'Absorptive capacity' *Administrative Science Quarterly* 35: 128-152.

Coleman, J.S. (1994) *Foundations of Social Theory.* Cambridge MA: Belknap Press.

Coleman, J.S. (1988) 'Social Capital in the creation of Human Capital' *American Journal of Sociology,* 94

Supplement, S95-S120
Coleman, J.S., Katz, E., & Menzel, H. (1966) *Medical Innovations.* Indianapolis: Bobbs-Merrill.
Cook, K. S., & Rice, R.R. (2003). "Social Exchange Theory." In: Handbook of Social Psychology, Ed. Delamater, J. Pp. 53-76 New York: Kluwer Academic/Plenum Publishers.
Cross, R., Parker, A., & Borgatti, S. (2001),'Knowing what we know: Supporting knowledge creation and sharing in social networks', *Organizational Dynamics*, 30(2), 100-120
Dahl, M.S., & Pedersen, C.Ø.R. (2004), Knowledge flows through informal contacts in industrial clusters: myth or reality?, Research Policy, 33, 1673-1686
Deckop, J.R., Cirka, C.C., & Andersson, L.M. (2003) 'Doing Unto Others: The Reciprocity of Helping Behavior in Organizations' Journal of Business Ethics 47: 101-113
de Solla Price, D.J., & Beaver, B.D. (1966), ' Collaboration in an Invisible College', *American Psychologist*, 21, 1011-1018
Dougherty, D., & Hardy, C. (1996) 'Sustained product innovation in large mature organizations: overcoming innovation to organization problems' *Academy of Management Journal*, 39(5), 1120-1153
Emerson, Richard. 1972 'Exchange Theory Part I: A Psychological Basis for Social Exchange.' In Sociological Theories in Progress, Eds. Berger, J., Zelditch, M., and Anderson, B. Pp. 38-57 Boston: Houghton Mifflin.
Ferrary, M. (2003) 'The Gift Exchange in the Social Networks of Silicon Valley' *California Management Review,* 45(4), 120-138.
Flynn, F.J. (2003) 'How much should I give and how often? The effects of generosity and frequency of favor exchange on social status and productivity', *Academy of Management Review*, 46(5), 539-553
Freeman, C. (1991) "Networks of innovators" *Research Policy* 20: 499-514.
Frenzen, J.K. & Nakamoto, K. (1993), 'Structure, Cooperation, and the Flow of Market Information', The Journal of Consumer Research, Vol. 20, No. 3 (Dec., 1993), pp. 360-375
Furukawa, R., & Goto, A. (2006), 'The role of corporate scientists in innovation', Research Policy, 35, 24-36
Gabbay, S.M., & Zuckerman, E.W. (1998) 'Social capital and opportunity in corporate R&D' Social Science Research 27(2): 189-217.
Galunic, C. D & Rodan, S. (1998). "Resource recombinations in the firm: knowledge structures and the potential for Schumpeterian Innovation." *Strategic Management Journal,*. Vol 19: 1193-1201
Goffman, E. (1971), *Relations in public*, Harmondsworth: Penguin
Gouldner, A.W. (1960) "The Norm of Reciprocity" *American Sociological Review* 25: 161-178.
Granovetter, M.S. (1973) 'The Strength of Weak Ties' *American Journal of Sociology* 78, 1360-1380
----, (1985) "Economic Action and Social Structure" *American Journal of Sociology* 91(Nov): 481-510.
Gulati, R. (1995) "Does familiarity breed trust" *Academy of Management Journal* 38: 85-112.
Hanneman, R. A. & Riddle, M. (2005) *Introduction to social network methods.* Riverside, CA: University of California, Riverside (published in digital form at http://faculty.ucr.edu/~hanneman/)
Hansen, M.T. (1999) "The Search-Transfer Problem" *Administrative Science Quarterly* 44(1): 82-111.
Henkel, R.H. (1976), Tests of Significance., Newbury Park, SAGE Publications.
Homans, G.C. (1950), *The Human Group*, New York: Harcourt, Brace
Ingram, P. & P.W. Robert (2000) "Friendship among competitors in the Sydney Hotel Industry" *American Journal of Sociology* 106: 387-423.
Katz, R., & Tushman, M.L. (1981),'An investigation into the managerial roles and career paths of gatekeepers and project supervision in a major R&D facility', *R&D Management,* 11, 103-110
Knight, K.E. (1967) 'A Descriptive Model of the Intra-Firm Innovation Process' *Journal of Business* 40(4): 478-496.
Knoke, D., & Burt, R.S. (1983), 'Prominence' *In: Applied Network Analysis: A methodological introduction,* Eds. Burt, R.S. & Minor, M.J., 195 – 222. Beverly Hills, CA; Sage.
Knoke, D., & Kuklinski, J.H. (1982) *Network Analyses*, Newbury Park, CA : Sage.
Kogut, B., & Zander, U. (1992), 'Knowledge of the Firm, Combinative Capabilities, and the Replication of Technology', *Management of Technology,* 3(2), 383-397

Kreiner, K., & Schultz, M. (1993) "Informal Collaboration in R&D." *Organization Studies* 14(2): 189-209
Landry, R., N. Amara & M. Lamari (2001) "Utilization of social science research knowledge in Canada" Research Policy 30(2): 333-349.
Larsen, D. & Watson, J.J. (2001) 'A Guide Map to the Terrain of Gift Value' *Psychology & Marketing*, 18(8), 889-906
Laumann, E.O., & Knoke, D., (1987), *The organizational state: social choice in national policy domains*, Madison, University of Wisconsin Press.
Lawler, E., Thye, S., & Yoon, J. (2000) 'Emotion and group cohesion in productive exchange', *American Journal of Sociology*, 106, 616-657
Marsden, P.V. (1990), 'Network data and measurement', *Annual Review of Sociology*, 16, 453-463
Marsden, P.V. (2004), 'Recent Developments in Network Measurement.', In: Models *and Methods in Social Network Analysis*, Eds Carrington, P.J., Scott, J., & Wasserman, S. New York: Cambridge University Press.
Mauss, M. (1954) [2000], *The Gift.* New York: Norton.
McCloskey, D.N.L. & Ziliak, S.T., 'The Standard Error of Regression', Journal of Economic Literature, 34(1), 97-114
Merton, R.K., (1968) "The Matthew Effect in Science" Science 159: 56 - 63
Molm, L., & Cook, K. (1995), Social exchange and exchange networks. In: Sociological perspectives on social psychology: Eds: Cook, K., Fine, G., & House, J. 209-235. Boston: Allyn & Bacon.
Moran, P (2005) "Structural versus relational embeddedness*" Strategic Management Journal* 26: 1129-1151
Moran, P., & Ghosal, S. (1996), 'Value creation by firms', *Academy of Management Proceedings,* 35-39
Nahapiet, J., & Ghosal, S. (1998), 'Social capital, intellectual capital, and the organizational advantage', *Academy of* Management Review, 23(20), 242-266
Nonaka, I. (1994) 'A Dynamic Theory of Organizational Knowledge Creation' *Organization Science* 5(1): 14-37.
Nooteboom, B. (2002) *Trust.* Cheltenham: Edward Elgar.
Nooteboom, B. (2000), *Learning and innovation in organizations and economies*, Oxford: Oxford University Press
Nooteboom, B. (1999), *Inter-firm alliances: Analysis and design*, London: Routledge.
Nooteboom, B. (1992), 'Towards a dynamic theory of transactions', *Journal of Evolutionary Economics*, 2, 281-299
Owen-Smith, J., & Powell, W.W. (2004), 'Knowledge Networks as Channels and Conduits' *Organization Science,* 15 (1): 5-21
Park, S.O. (2002) 'Regional innovation strategies in the knowledge-based economy' *Geo Journal* 53(1): 29-38
Podolny, J.M. (2001), 'Networks as the Pipes and Prisms of the Market' *American Journal of Sociology* 107(1): 33-60
Powell, W.W. (1996), 'Inter-organizational collaboration in the biotechnology industry', *Journal of Institutional* Theoretical Economy, 152: 197-215
Powell, W.W., Koput, K.K., & Smith-Doerr, L. (1996), 'Inter-organizational collaboration and the locus of innovation: Network of learning in biotechnology', *Administrative Science Quarterly,* 41, 116-145
Reagans, R. & McEvily, B. (2003) 'Network Structure and Knowledge Transfer' *Organization Science* 13(3): 232-248
Reagans, R. & Zuckerman, E. (2001), Networks, diversity and performance: The social capital of R&D units.', *Organization Science*, 12, 502-517
Rodan, S., & Galunic, C. (2004), 'More Than Network Structure: How Knowledge Heterogeneity Influences Managerial Performance and Innovativeness', Strategic Management Journal, 25, 541-562.
Rogers, E.M. (1995) *Diffusion of Innovations,* New York: Free Press
Schrader, S. (1991), 'Informal technology transfer between firms: cooperation through information trading', *Research Policy*, 20, 153-170
Sahlins, M, D. (1996), 'On the Sociology of Primitive Exchange", In: *The Gift: An Interdisciplinary Perspective*, Ed.

Komter, A.E., Amsterdam: Amsterdam UP.
Scott, J. (1991) *Social network analyses*. London: Sage.
Sherry, J.F. (1983), 'Gift Giving in Anthropological Perspective' *The Journal of Consumer Research,* 10(2), 157-168
Skvoretz, J. & Lovaglia, M.J. (1995) 'Who Exchanges with Whom' *Social Psychology Quarterly* 58: 163-177
Sprecher, S. (1988), 'Investment model, equity, and social support determinants of relationship commitment', *Social Psychology Quarterly*, 51, 318-328
Starpoli, C. (1998) 'Cooperation in R&D in the pharmaceutical industry' *Technovation* 18(1): 13-23
Sutton, RI; Hargadon, A (1996), Brainstorming groups in context: Effectiveness in a product design firm', Administrative Science Quarterly, DEC 1996; v.41, no.4, p.685-718
Szulanski, G. (1996), 'Exploring internal stickiness: impediments to the transfer of best practice within the firm, *Strategic Management Journal*, Winter Special Issue, 17, 27-43
Tsai, W. & Ghosal, S. (1998), 'Social Capital and Value Creation: The role of intra firm networks', *Academy of* Management Journal, 41 (4), 464-476
Tushman, M.L. & Scanlan, T.J. (1981) 'Boundary spanning individuals: Their roles in information transfer and their antecedents' Academy of Management Journal 24: 289-305
Tushman, M.L. (1977) 'Special boundary roles in the innovation process' *Administrative Science Quarterly* 22: 587-606
Tushman, M.L., & Katz, R. (1980), 'External communication and project performance: an investigation into the role of gatekeepers', *Science*, 26, 1071-1085
Uehara, E. (1990) 'Dual Exchange Theory, Social Networks, and Informational Support', *The American Journal of Sociology* 96: 521-557.
Uzzi, B. (1999), 'Social relations and networks in the making of financial capital', *American Sociological Review*, 64, 481-505
Uzzi, B. (1997), 'Social Structure and competition in inter firm networks' *Administrative Science Quarterly* 42(1): 35-67
Uzzi, B. (1996), 'The sources and consequences of embeddedness for the economic performance of organizations: The network effect', American Sociological Review, 61, 674-698
Von Hippel, E. (1994) "'Sticky information' and the locus of problem solving" *Management Science* 40(4): 429-439
Von Hippel, E. (1987) 'Cooporation between rivals: Informal know-how trading', *Research Policy*, 16, 291-302
Walster, E., Berscheid, E., & Walster, G.W. (1973) 'New Directions in Equity Research' *Journal of Personality and Social Psychology*, 25(2), 151-176.
Wasserman, S., & Faust, K. (1994) *Social Network Analysis*. Cambridge, England: Cambridge UP.
Wenger, E.C., & Snyder, W. (2000) 'Communities of Practice the Organizational Frontier' *Harvard Business Review*, 139-145
Wenger, E.C. (1998) Communities of Practice: Learning, meaning and identity, Cambridge: Cambridge UP.
Wiig, K.M. (1997), 'Integrating intellectual capital and knowledge management', *Long Range Planning*, 30(3): 399-406.
Winter, S.G. & Szulanski, G (2001), 'Replication as Strategy, *Organization Science*, Vol. 12, No. 6., pp. 730-743.
Yamaguchi, K. (1996), 'Power in Networks of Substitutable/Complementary Exchange Relations: A Rational-Choice Model and an Analysis of Power Centralization'. American Sociological Review, 61, 308-332

Appendix A

Box 6-2 Summary of Key Research Variables

Variable	Variable Description
Dependent	
- Exchange Frequency	An overall measure of favor exchange frequency was calculated by averaging the ratings of favor exchange with the focal employee.
- Perceived Generosity	A measure which captures the extent to which alters perceived the focal employee to be generous in his favor exchange with them.
- Objective Performance	The number of patents applied for per researcher was collected, as a proxy for innovation output.
- Subjective Performance	Supervisor's evaluation of the researcher's creativity (defined as the ability to come up with novel and useful ideas) over the last 12 months.
Independent	
- Knowledge heterogeneity	The measure reflects the respondents assessment of the extent to which the knowledge base of the reported alter was similar or dissimilar to their own.
- Tie strength	A measure capturing relational strength with reported alter, calculated by means of two measures: 'closeness' and 'communication frequency'.
- Brokerage	The brokerage index measures the percentage of alters in ego's network which are not directly connected to one another (Hanneman & Riddle, 2005) which puts ego in a position to act as a go between.
- In-degree centrality	The in-degree centrality measure offers a basic indication of the network position of an individual actor as it measures the number of (incoming or in-degree) ties that make up an ego-network (Wasserman & Faust, 1994).
Control	
- Tenure	Respondents were asked to report their tenure in the organization (years), as a possible explanation for performance.
- Gender	Gender respondent.[0= male, 1 = female]
- Lab size	The measure reflects the size of a respondent's unit reflecting the notion that the number of people working at a given department could be an important factor of networking and exchange opportunities.
- Jobgrade: Sr. scientist	A measure of hierarchy based on three job grades recoded into a dummy variable [0= scientist, 1 = senior scientist, 2= manager].
- Jobgrade: Management	A measure of hierarchy based on three job grades recoded into a dummy variable [0= scientist, 1 = senior scientist, 2= manager].

Appendix B

Box 6-3 Summary of Key Survey Questions

	Summary of Key Survey Questions
Name generator	Part of the main survey send to all selected participants.
	Over the past 6 months are there any work related contacts from whom you regularly sought (research related) information and advice to enhance your effectiveness as a researcher? Your most valued work contacts.' (cf. Burt, 1992; Podolny and Baron, 1997; Marsden 1990).
Name interpreters	Part of the main survey send to all selected participants.
Respondents answered the questions below on a 5-point scale, ranging from 1 to 5 [ranging from daily to yearly].	1. How frequently did you interact with the person in question? (cf. Wasserman & Faust, 1994; Burt, 1992)
	2. How similar or different is your knowledge from your contacts' knowledge? (cf. Rodan and Galunic, 2004)
	3. How close is your working relationship with the person in question? (cf. Marsden & Campbell, 1984; Burt, 1992)
	4. Please rate the frequency with which you exchange favors with regard to the innovation development process with this person (very infrequently vs. very frequently)? (cf. Flynn, 2003).
	5. Please rate who has given more in this exchange relationship? (cf. Flynn, 2003).
Assessing innovation performance	Part of the survey send to senior managers asked to assess performance of employees in their team.
Respondents answered the questions below on a 5-point scale, ranging from 1 to 5 [ranging from weak to outstanding].	Please write the number from the 5-point scale that best corresponds to your assessment of this knowledge workers performance over the last 6 months. (cf. Rodan and Galunic, 2004).
	1. To what extent is this person particularly creative: someone able to come up with novel and useful ideas?
	2. To what extent is this person good at implementing novel ideas?
Control variables	
	1. What is your age?
	2. Please indicate your tenure with the organization.
	3. Please indicate your tenure with the department you currently work for.
	4. How many scientific articles have you published during your tenure at Company X/Y?
	5. How many patens have you applied for during your tenure at Company X/Y?

Appendix C

The main findings of our empirical study were presented in chapter 6. Paragraph 6.2.2 amongst others provided an overview of network relationships as observed in company Y. In order to preserve structural clarity results for company X could not be incorporated, however for the sake of completeness this section will provide a comparable network analyses for company X.

The socio-gram for company X consists of 37 researchers. The nodes represent researchers and lines indicated research related information and advice exchanges (224 relationships[81]).

Figure 6-5, then provides a visual summary of the network configuration of the research lab in question. The R&D activities for company X were concentrated in one R&D department, as a result and in contrast to company Y, divisional boundaries were not an issue[82]. Again Multi-Dimensional Scaling techniques are used to position nodes that are 'more similar' closer together. Similarity in this context is based on the actors citing one another and the extent to which they shared the same alters.

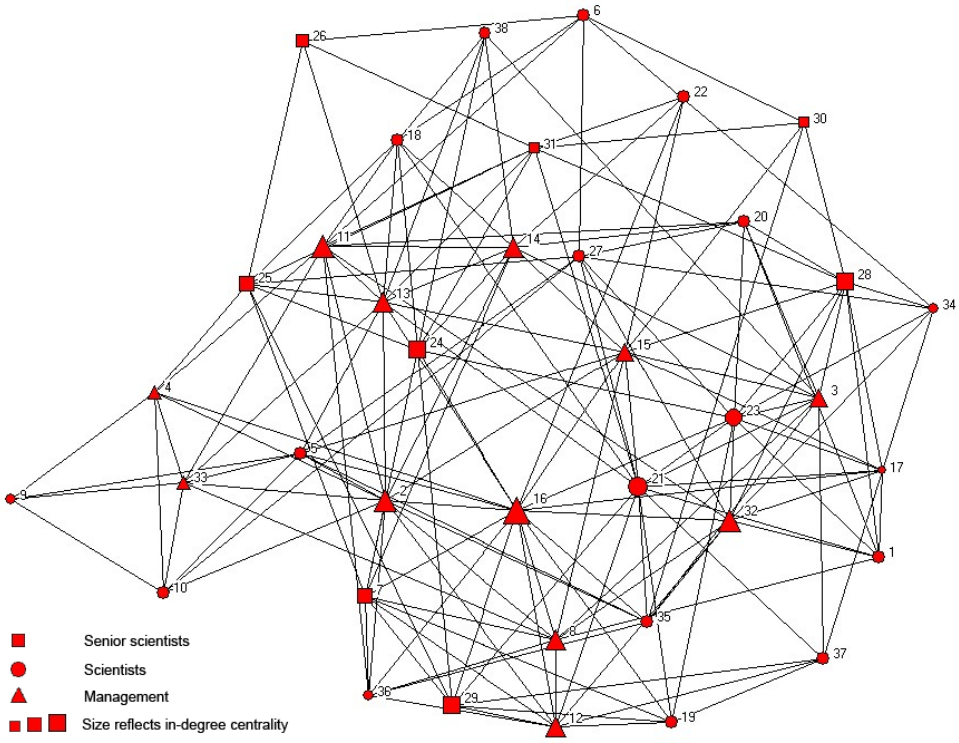
Table 6-8 Illustrative Network Positions

	Men Network Size	Two Step Reach	Normalized Brokerage	Mean Path Distance (Min- Max) for the 186 connected respondents in the graph.
Manager (12)	9,25	97,3	0,35	2,06 (1,7-3,5)
Senior Scientist (8)	5,25	64,53	0,30	2,37 (2,1-3,1)
Scientist (17)	4,06	52,7	0,31	2,70 (1,9-4,0)
Mean (37)	6,0	64,22	0,32	2,42 (1,7-4,0)

81 Company X provided a total number of 224 relationships, the social network contained no social isolates.

82 The socio-gram therefore utilizes a single node color.

Figure 6-5 Knowledge Exchange Network



While the socio-gram provides us with an overall understanding of the context, table 6-10 allows us to zoom in further by considering job grades and relating these to the corresponding network (position) measures. The measures quantify differences in network positions actors, categorized by job grade, inhabit in the social context in which they are embedded. Informative to a high degree, the network measures employed allows us to consider the implications in terms of opportunities and constraints.

The first column of the table in figure 2 shows that scientists' *In-degree Networks* were on average substantially smaller than those of senior scientists and managers. While scientists had networks averaging 4,06 contacts, a senior scientist's average network consisted of 5,25 contacts, only to be surpassed by an average of 9.25 contacts for managers. Network size provides us with a straightforward and effective measure of an actor's centrality. Having many ties is considered beneficial in terms of access to resources and deal maker opportunities.

Column two of the table, provides the *Two-Step-Measure* for the different job grades. The measure reports the percentage of actors a focal actor can reach within two directed steps of ego (friends of friends). As becomes clear from the table, scientist are on average able to reach 52,7 percentage of the entire network increasing to 64,53 and 97,3 percent for senior scientists and managers respectively. Two-Step-Reach is influenced directly through

network size (more contacts, more indirect contacts) and indirectly through the network size of a focal actor's alters. Having more central contacts enables a focal actor to access a larger part of the network without having to incur the costs in terms of network maintenance.

The table's third column considers the *Normalized Brokerage* measure. Brokerage considers the number of pairs which are not directly connected, creating an opportunity to act as a broker between these two unconnected alters. As such structural holes or non-redundancy (Burt, 1992) are considered to facilitate access to diverse sources of information providing actors access to more timely and relevant information about upcoming opportunities and complications or contingencies. The table indicates that higher job grades are associated with more brokerage opportunities, even when accounting for the associated larger networks.

In the final column of the table, *Average Geodesic Path Distances* are considered. Using the path distance measure the minimum number of relations required to connect alters are determined. Average path distance is calculated for each actor, resulting in the mean geodesic distance for a respondent which captures an actor's closeness to all other nodes in the network. In case of a direct contact between two individuals the distance is one, a connection that takes two directed steps (friends of friends) is two etc. As network density increases the path distances will generally become smaller and vice versa (Hanneman & Riddle, 2005). Results for the knowledge exchange network in figure 6-5 show that the diameter of the network (largest path distance) is 4 steps with an average of 2.42 steps. Given the relatively small overall size of the social network in Company X average path distances do not differ significantly across job grades. Actors are on average able to reach every other actor within 3 steps.

Chapter 7
Discussion and Conclusions

7.1 Introduction

Technics in man's life is conscious, arbitrary, alterable, personal, inventive. It is learned and improved (Spengler, 1932, p25).

[….] the phenomena with which we have to deal: the unavoidable imperfection of man's knowledge and the consequent need for a process by which knowledge is constantly communicated and acquired. (Hayek, 1945, p 530).

Technology and the knowledge thereof, on a basic level, has become the cornerstone of human civilization and prosperity, a notion also explored by Sprengler (1932) in Man and Technology. In our everyday live, both directly and indirectly, we use or profit from innovations[83], essentially an outcome of knowledge creation, invented by past famous or oftentimes long forgotten inventors. It seems that today's economic reality like never before embraces as well as actively pursues knowledge creation and application both for its own sake and for economic value creation. Bransford, Brown, and Cocking (1999) for example conclude that '[…] information and knowledge are growing at a far more rapid rate than ever before in the history of humankind.". As such, knowledge has become an organization's and on a macro level society's key resource. This dissertation, echoing Hayek's (1945) observations on communication and acquisition of knowledge, sought to better understand the process of knowledge transfer essential for knowledge creation. Unlike Hayek however, I argue that (especially) knowledge transfer continues to take place (efficiently) outside the market (or hierarchy for that matter), by means of interpersonal gift exchange cycles. That is to say, I not so much argue against other forms of (knowledge) exchange mechanisms, as I endeavor to explain the value and prevalence of an alternative exchange mechanism; gift exchange. This study empirically has focused on intra-organizational knowledge transfers between R&D scientists, believed to be at the core of an organizations knowledge creation capability. At the same time, I have sought to embedded gift exchange theoretically explaining both its value as its incidence. I will start this concluding chapter by discussing both theoretical and empirical (key) findings, followed by managerial implications, limitations, and suggestions for future research.

83 The underlying principles we, as pointed out by Hayek, do not necessarily understand: "We make constant use of formulas, symbols, and rules whose meaning we do not understand and through the use of which we avail ourselves of the assistance of knowledge which individually we do not possess". (Hayek, 1945, p528)

7.2 Key findings

Throughout the course of this study we have argued consistently for and weighed the merits of gift exchange in the context of knowledge development. In fact, arguing in favor of gift exchange, this study implicitly (and explicitly) underscores the importance of cooperation and coordination. The extent to which actors are willing to cooperate, that is exchange, is crucial for organizations and societies. Conceptually, gift exchange is well positioned to buttress cooperation between individuals under uncertain circumstances. Indeed, contrary to a more romantic notion of what constitutes a gift, most resources can be gifts, as gifts may be defined[84] as those goods, material or immaterial, including knowledge, feedback and tips, given to an alter in the expectation that it will be accepted and reciprocated (van der Eijk, et al., 2006). As such, gift exchange could represent a powerful motivational driver behind intra (or inter) organizational knowledge transfers. Chapters 2, 3 and 4 explored different bodies of literature and make a case for gift exchange in the context of knowledge creation. Chapters 5 and 6 proceeded to investigate the veracity of our research question: 'What is the impact of gift exchange incidence and network position on individual innovation performance?'. Knowledge transfers as any exchange involves actors, resources and structures (Molm, 2003), this study addresses the extend to which these different elements affect innovation outcomes. Primarily this study seeks to make a case for cooperation in research and development. The different sections of this study have sought to contribute to that aim emphasizing different aspects of exchange, cooperation in communities as well as knowledge its characteristics and its transfer.

In chapter 2, we argue that while cooperation and coordination via the market or hierarchy remain important, gift exchange has often been the preferred alternative in the context of knowledge development and diffusion. That is to say, depending on the circumstances one mechanism may be better suited to provide coordination while in other circumstances coordination mechanisms work in tandem (Adler 2001; Bradach & Eccles 1989). It is argued that gift exchange is conceptually different from the market or hierarchy, and as such requires additional concepts to understand it (Biggart & Delbrigde, 2004).

Chapter 3 focuses on relations between individuals in a community and the cooperation between them. Subsequently, the notion of social capital is introduced capturing the idea that relationships and social networks are a valuable asset, in that they can facilitate action. As such, social capital resides in members of a group, and in their relations. Understanding social capital is relevant for understanding what is going on within and between companies. Coleman (1988) emphasizes that social capital constitutes an aspect of the social structure and is capable of facilitating the actions of individuals within that structure. These actions relate to the (potential) benefits of social capital, identified and categorized by Sandefur and Laumann (1998): information, influence and solidarity. These

84 Alternatively and more formally gift exchange is defined in this dissertation as the, in fulfillment of an obligation or spontaneous, conference of some material or intangible benefit that is, consciously or unconsciously, subject to expectations of reciprocity whereby the particulars of the return in terms of form and time are left unspecified at the time of the transaction.

benefits allow actors to achieve ends which would be impossible to achieve without social capital, or only by means of (significant) additional costs. A review of the literature showed that much attention in the literature has been directed to identifying social capital and less so to issues of how social capital is created, how it is put to use and how it is maintained. These processes are not self-evident: the benefits of social capital do not materialize at will and not every individual is likely to benefit to the same extent. The literature on gift exchange suggests ways of opening the black box proposing that creation, use and maintenance of social capital is to be understood as a corollary of gift exchange. From this literature, social capital emerges as a consequence of exchange relations, capturing the procedural aspects of social relationships. The literature on gifts suggests mechanisms for reciprocity, equity, interpretation/meaning and the strength of a relationship, which may be tied up with the existing literature on social capital. Gift exchange allows actors to forge and personalize relationships and to develop guarantees through personal bonding (Zucker 1986; Shapiro 1987). As anthropologists in line with Mauss (1954) have argued: there is a need to give, and receive, and reciprocate in these circumstances in particular. If one does not adhere to this, one may be ex-communicated and barred from exchanges that are both socially and economically meaningful. The creation, use, maintenance and depletion of social capital is, thus, to be understood as a corollary of gift exchange. Thus, in time, social capital is created and sustained by gift exchange, but at the same time, once created, social capital facilitates exchange of both gifts and market commodities particularly under conditions of uncertainty (Bourdieu, 1986; Nahapiet & Ghosal, 1998).

Chapter 4 explores, in some detail, new knowledge creation within the context of the firm. As development of new knowledge is impossible without previously developed knowledge, actors are depended on one another. The need for cooperation, specifically exchange of knowledge and information, stems from human (limited) knowledge and the distribution, dispersed in both time and space, of knowledge among various actors. Hence, firm innovativeness is largely dependent on the cooperation between people and the relationships they entertain within (and beyond) the firm. However, the extraordinary characteristics of knowledge (e.g. uncertainty, asymmetry and social dimensions related to knowledge) make the exchange of knowledge between people by no means an easy or self-evident process (Hansen 1999; Szulanski 1996; Winter & Szulanski 2001). For these reasons a number of scholars have, in the past, suggested that a mode of exchange and coordination different from that of market or hierarchy may be better suited for exchange of knowledge (Bradach & Eccles 1989; Dore 1983; Macaulay 1963; Ouchi, 1980; Powell 1991). Whenever achieving some goal involves the assistance of others, actors will still need to enlist the cooperation of other parties. In the context of innovations, for instance, relational ties and networks do play a crucial part in locating and accessing relevant knowledge. As such informal (and formal) cooperation between corporate scientists within and between firms is not an unknown observation (cf. Allen 1977; Kreiner & Schultz 1993; Von Hippel 1987; or the communities-of-practice literature Wenger & Snyder 2000; Wenger 1998; Brown & Duguid 1991, 2001), but tends not to be conceptualized in terms of gift exchange. This chapter argues that the notion of gift exchange allows one to explain *why* persons exchange

knowledge with each other even if they are not obliged to by contract or instruction. Gifts can be non-material to include knowledge and are exchanged for multiple reasons. Gift exchange creates mutual trust as well as informal obligations between persons, and offers participants a perspective for understanding the way in which informal, but also formal relations take shape and how they may or may not contribute to knowledge transfer.

Bridging theory and empirics, chapter 5 elaborates on the particular research design adopted by this study. Qualitative and quantitative methodologies both were believed to offer valuable insights. Subsequently, data collection methods, analysis as well as the relevant variables were explained and justified.

So far, there is little empirical research to guide theoreticians and practitioners. In chapter 6 the conceptual contribution of relational and structural attributes to the production of knowledge are investigated empirically. In particular, this chapter tested the supposition that creative and productive researchers are more likely to inhabit favorable networks positions and actively engage in exchange. The study showed mixed results in regards to the effect of gift exchange on innovation success. The regression results showed that although gift exchange incidence was associated with subjective innovation performance (e.g. creativity), this effect could not be demonstrated for objective innovation performance (e.g. patents output). At the same time, results indicate that an actor's position within the network (centrality) has a positive and significant effect on both subjective and objective innovation performance. The results suggest that a larger network with more exchange partners positively contributes to individual innovativeness. This result is in line with previous studies which indicate that as an actor's centrality increases and an actor is connected to more alters their access to resources and new and novel ideas increases (Burt, 2004; Granovetter, 1973). In addition to the economic outcomes (e.g. innovation performance) this study also explores the impact of gift exchange on social or relationship variables. As has been argued, gift exchange theory posits that gifts are associated with informal social obligations strengthening the givers entitlement to future support. Thus, outstanding social obligations will make it easier to call on the recipient in the future (as well as likely that support will be actually provided). Results indicate that the extent to which actors were considered generous (that is, perceived to have given more and eligible to a return gift) was associated with both network centrality and brokerage opportunity. Interestingly and contrary to expectations formal hierarchical status proves not to be a significant predictor of perceived generosity. These findings suggests that it is not so much hierarchical status that influences perceived generosity as is an actor's network position.

Central to this study has been the idea that cooperation in social communities is essential, inevitable even, due to the particular characteristics of knowledge. While knowledge transfers continue via both market and hierarchy, the social nature of knowledge

creation underscores the importance of gift exchange. Conceptualizing knowledge transfer as gifts represents as much an exchange mechanism as a metaphor. A metaphor which will enable companies and practitioners to make explicit what by its very nature is likely to remain implicit. This study started with a quote from Alexis de Tocqueville. His observation that "In democratic countries knowledge of how to combine is the mother of all other forms of knowledge; on its progress depends that of all the others." captures a process (i.e.(re) combination) which is believed to be essential to knowledge creation and is at the hart of exchange. The quote comes, of course, from de Tocqueville's classical report on American society, "Democracy in America", a study more about America, the society and its people than on knowledge creation. In fact, the quote is preceded by the observation that "Americans of all ages, all stations of life and all dispositions are forever forming associations. There are not only commercial and industrial associations in which all take part, but others of a thousand different types - religious, moral, serious, futile, very general and very limited, very large and very minute.". However, the willingness to cooperate so marveled by de Tocqueville as argued by our study is not just essential for society but also, and maybe even more so, key to successful and effective organizational knowledge creation.

7.3 Contribution to literature

In the introduction we voiced our initial expectations regarding the contribution this study would make to extant literature. The study is motivated to a large extent by the observations of authors who conclude that micro processes or social dimensions of knowledge sharing in the innovation development process are in need of further exploration (Tsai, 2000; Kim & Mauborgne, 1998; Darr, Argote & Epple, 1995; Obstfeld, 2005). In line with the title of this book, this study set out to go 'behind networks' as we explore the underlying mechanism for informal (and formal) cooperation within networks. In so doing, we made a number of contributions to existing literature.

Firstly, this study proposed gift exchange as an alternative to the hierarchy and market dichotomy. Although alternatives proposes by previous studies (e.g. social relations (Adler & Kwon, 2002), communities (Adler, 2001; Bowles & Gintis, 1998), clans (Ouchi, 1979;1980), (social) networks (Powell, 1990; Miles & Snow, 1986; Thorelli, 1986)) recognize to some extent the social nature of exchange outside of the market and hierarchy debate, they fail to find a common denominator. Disciplines outside of economics (notably anthropology) have demonstrated that gift exchange has long since been used by men to structure exchange. Not only is the mechanism as such well established it also incorporates a range of mechanisms[85] that account for its effectiveness. There is some recognition of this, which this thesis subsequently synthesizes and elaborates upon.

Secondly, this research built on and extended social capital literature. Social

85 Gift exchange creates a shared frame of reference, reduces uncertainty which overtime can result in mutual trust and is based on social obligations. A number of social mechanisms such as expected benefits of continued future cooperation, hostage and reputation affect the incentive structure of participants to honor their social debts.

capital residing in members of a group and their relations has been widely used to explain the value of relations and the way they can facilitate action. A substantial amount of research, in different areas, has focused on the (mostly positive) consequences of social capital (e.g. Alder & Kwon, 2002; Jackman & Miller, 1998; Field, 2003; Fine, 2000; Portes & Sensenbrenner, 1993; Woolcock, 1998). Significantly less has been written about the way social capital is created, maintained or depleted, which is at stake in this thesis. Conceptually, this study has introduces and ties gift exchange theory into social capital literature streams. As such, we demonstrate its potential in proposing that creation, use and maintenance of social capital is to be understood as a corollary of gift exchange.

Thirdly, Social Network Analysis (SNA) suffers from an action problem as professed by a number of authors (see Obstfeld, 2005) in that it fails to explain how people in a network actually share knowledge, using the network structure that is there. We offer a solution to the action problem faced by this literature by offering the concept of gift exchange. As a means of creating and maintaining social ties, gifts explains why individuals engage in exchange, how relations are sustained and will be used when knowledge transfer is explored.

Fourthly, this study underscores the importance of the position of actors within a network for individual innovation performance. Both individual creativity and patent output, two measures of innovation performance, were shown to be strong predictors.

Fifthly, research results on 'perceived generosity', the extent to which people feel the relationship is balanced, demonstrate the significance of alternative predictors. Results of this study provides grounds to reconsider the notion that hierarchical status presents a strong predictor of perceived reciprocity, as put forward in literature (Goffman, 1971; Buunk, Doosje and Hopstaken, 1993, Merton, 1968; Homans, 1950; Bodeman, 1988). Instead results indicate that the network position an individual inhabits holds more explanatory power, as it influences the way alters assess a focal actor's generosity.

7.4 Managerial relevance/implications

Conceptualizing knowledge transfers as gift exchanges offers managers a perspective for understanding the informal but also formal exchanges that are so essential to knowledge creation. Although that notion alone merits consideration, findings from this study offer opportunities for management to influence and better manage (informal) knowledge flows.

Firstly, we have shown how researchers involved in gift exchange are more successful as researchers. At the same time, many of these exchanges are purely interpersonal (Allen, 1977), driven by personal micro objectives (Bouty, 2000) and take place 'without management support or urging' (Leonard-Barton & Deschamps, 1988; 1252). While these exchanges represent important acquisition and learning processes essential for innovation, they offer potential for knowledge spillovers. Recognizing that interpersonal exchange essentially is an exchange of gifts, with the give and take that it entails, two managerial implications become apparent. On the one hand, too strict a policy of spill-over control might hamper the innovation development process since those who do not give, do not receive in return. On the other hand, the importance of interpersonal exchange and the need

for companies to preserve core competencies (cf. Henkel, 2006) requires companies to debate the issue and make explicit what represents company core and non-core technologies or knowledge. Thirdly, gift exchange's effectiveness in part depends on the extend to which the incentive structure of an organization can be altered in such a way that honoring social debts and cooperation becomes an effective course of action for the individual. 'Encouraging' the dynamic of (knowledge) exchange therefore requires an appropriate structural arrangement. Organizations can actively endorse and invest in 'communities of practice'(Wenger & Snyder, 2000; Brown & Duguid, 1991, 2001; Nonaka, 1994), which facilitate exchange, in that they serve as an intra-network clearinghouse enabling quick identification of and connection with those individuals with or access to relevant knowledge, a reference mechanism by providing the opportunity to evaluate the knowledge of others without having to contact al relevant parties, a closed structure allowing the formation of reputation and trustworthiness, and lastly as repositories of knowledge and best practices (Lesser, 2000). Lastly, especially when the aim is to stimulate knowledge transfer within the firm, possibly across department boundaries, managers may be well advised to purposefully start the process of giving knowledge.

Secondly, a researcher represents scientific and human technical capital (S&T capital) which translates into the sum of researcher's professional network ties and his technical skills and resources (Bozeman, Dietz & Gaughan, 2001). This definition explicitly recognizes professional networks, as the conduits through which knowledge is exchanged, as an important determinant for scientists' performance. Management is well advised to actively promote network development within the organization. Indeed, to some extent managers can shape and encourage individual networks formation. First of all, recruitment can be partly based on scientists' networks in the relevant scientific or inter-organizational communities. Essentially buying the company access into specific networks. In addition, organizations can shape formal networks in ways thought to contribute to the development of (informal) knowledge networks. The extent to which organizations can create informal networks remains an interesting question. However, we might not need to resolve that debate as formal networks have been shown to both overlap with and set the stage for informal networks (Dolfsma, 2008). Indeed, as formal relations are considered more purposefully malleable, organizations seem well advised to explore available options. For example, inter-organizational and inter-personal networks could be deliberately supported and created by means of job rotating systems in R&D settings (Griffing et al, 1996). Thereby, providing opportunities for employees to get to know, trust and work with different researchers (e.g. learn their respective knowledge base and expertise) and departments. Moreover, despite 'death-of-distance' through technology claims, face-to-face meetings remain essential for the creation and maintenance of informal networks (Park, 2002; Dar, Argote & Epple, 1995). Actively building internal communities and networks will require organizations to invest in opportunities for face-to-face encounters (e.g. informal meetings, workshops, seminars and conferences). Furthermore, organizations can benefit from mapping organizational networks, allowing them to anticipate possible network disruption following the departure of key employees. Lastly, mentor program where new employees are paired with 'well-

connected' senior personnel can speed up network formation for new employees. In this particular situation, gift exchange dynamics might be especially effective. Since new employees initially will have less to offer, they are likely to be indebted to their mentor but overtime they will be able to reciprocate to the benefit of both parties.

7.5 Limitations and future research

This empirical study is marked by a number of limitations that should be acknowledged and which should be addressed in future studies.

First, by design this study focused on exchanges that take place within the organization, that is inter-organizational exchange. The design allowed us to investigate the gift exchange properties of knowledge transfer in a more 'controlled' setting. An intra-organizational setting provides no boundary for network analysis, as it enables one to survey (with adequate organizational support) complete networks, and is likely to make confidentiality considerations in exchange decisions less salient. In the future, however it might be worthwhile to include actor's external networks and exchange patterns as well. Inclusion of this type of data might provide a better overview of an actor's network resources and its effect on innovation performance. In addition, there might be differences in exchange behavior that could be become apparent by a more all-encompassing approach.

Second, there are factors that limit generalizability of the results this study. The organizations studied both represented R&D laboratories within the food-technology sector. It is therefore possible that the results of this study are specific to this industry. Future research might therefore include, as part of a replication or extension strategy, different (for example technology or market driven) industries.

Third, the study could be criticized for the use of cross-sectional data, limiting the extent to which causal inferences can be drawn. We controlled for different effects by including several control variables and theory provided a solid bedrock, but cause and effect analysis can benefit from an indepth examination via a different research design. Indeed, longitudinal data in addition to providing further support or refutation could offer insight in how actor networks change over time and the extent to which these developments can be related to gift exchange behaviors.

Fourth, assessing the accuracy of gift exchange accounts of respondents pertaining to other employees is difficult. The extent to which respondents are affected by (ego centric) (Sprecher, 1988) memory bias applies to network research in general (e.g. name generating and interaction frequency) (Marsden, 1990; Brewer, 2000; Marin, 2004; Kogovsek & Ferligoj, 2005) and gift exchange research in particular (e.g. frequency and perceived generosity). However, the extent to which actors accurately recall exchange balance is not necessarily important. Since, as Blau (1964) points out evaluations of exchange is a subjective matter, and these subjective interpretation guide future gift exchange behavior. Nonetheless, a research design that limits the influence of memory bias might be a research avenue worth exploring. A possible research strategy might be to incorporate different survey measures to assess the construct 'perceived generosity'.

Fifth, while this study has investigated general relationships between gift exchange and performance, the set up of this particular study did not allow for a more fine-grained analysis of the gift exchange process. In line with a framework as proposed by Bouty (2000) subsequent projects might include a typology of gifts, type of exchange setting (Fiske, 1992) and inter and intra-organizational exchanges. Such an approach could also shed light on the exchange, or trading if you will, of resources of a more confidential nature.

References

Adler, P.S. (2001) 'Market, Hierarchy, and Trust : The Knowledge Economy, and the Future of Capitalism' Organization Science 12(2): 215-234.

Adler, P.S. & Kwon, S.W. (2002) 'Social capital : prospects for a new concept', *Academy of Management Review*, 27(1): 17-40

Allen, T.J. (1977), Managing the flow of technology: Technology Transfer and the dissemination of technological information within the R&D organization, Cambridge MA: The MIT Press

Biggart, N.W., & Delbridge, R. (2004), 'Systems of exchange', *Academy of Management Review,* 29(1), 28-49

Blau, P. (1964) Exchange and Power in Social Life. New York: Wiley

Bodemann, Y.M. (1988), 'Relations of Production and Class Rule: The Hidden Basis of Patron-Clientage.', *In: Social Structures: A Network Approach*, Eds. Wellmann, B. & Berkowitz, S.D., Cambridge: Cambridge UP.

Bourdieu, P. (1986), 'Forms of Capital', In: Handbook of Theory and Research for the Sociology of Education., Ed.

Richardson, J. G. , New York: Greenwood Press.

Bouty, I. (2000) 'Interpersonal and interaction influences on informal resource exchanges between R&D researchers across organizational boundaries' *Academy of Management Journal* 43(1): 50-65

Bowles, S., & Gintis, H. (1998), 'The Moral Economy of Communities: Structured Populations and the Evolution of Pro-Social Norms', *Evolution and Human Behavior*, 19, 3-25

Bozeman, B., Dietz, J.S., & Gaughan, M. (2001),' Scientific and technical human capital: an alternative model for research evaluation', *International Journal of Technology Management*, 22 (7/8), pp. 716-740

Bradach, J.L., & Eccles, R.G. (1989), 'Price, Authority, and Trust: From Ideal Types to Plural Forms' *Annual Review of Sociology*, 15, 97-118

Bransford, J.D., Brown, A.L., & Cocking, R.R. (1999), *How People Learn: Brain, Mind, Experience*, and School, Washington, D.C.: National Academy Press

Brewer, D.D. (2000), 'Forgetting in the recall-based elicitation of personal and social networks', *Social Networks*, 22, 29-43

Brown, J.S. & Duguid, P. (1991), 'Organizational Learning and Communities of Practice' *Organization Science* 2(1): 40-57

----, (2001) 'Knowledge and Organization' *Organization Science* 12(2): 198-213.

Burt, R.S. , (2004) 'Structural Holes and Good Ideas' *American Journal of Sociology* 110: 442-455

Buunk, B.P., Doosje, B.J., Jans, L.G.J.M., & Hopstaken, L.E.M. (1993), Perceived Reciprocity, Social Support, and Stress at Work: The Role of Exchange and Communal Orientation, *Journal of Personality and Social Psychology*, 65(4), 801-811

Darr, E.D., Argote, L., & Epple, D. (1995) "The Acquisition, Transfer, and Depreciation of Knowledge in Service Organizations" *Management Science* 41(11): 1750-1762.

de Tocqueville, A. (1835) [1988], *Democracy in America*, New York: Harper Perennial

Dolfsma, W. (2008), Knowledge Economies: Innovation, Organization and Location, New York: Routledge

Dore, R. (1983) "Goodwill and the spirit of market capitalism" *British Journal of Sociology* 34(4): 459-482.

Eijk, R. van der, W. Dolfsma and A. Jolink (2006) No Black Box and No Black Hole: from Social Capital to Gift *Exchange*. Mimeo.

Ferrary, M. (2003), 'The Gift Exchange in the Social Networks of Silicon Valley', *California Management Review,* 45(4), 120-138

Field, J. (2003) *Social Capital*, London and New York: Routledge.

Fine, B. (2000) 'Social Capital versus Social Theory. Political Economy and Social Science at the Turn of the Millennium', London and New York: Routledge.

Fiske, A.P. (1992), 'The Four Elementary Forms of Sociality: Framework for a Unified Theory of Social Relations', *Psychological Review*, 99(4), 689-723

Granovetter, M.S. (1973) 'The Strength of Weak Ties' *American Journal of Sociology* 78, 1360-1380.

Griffin, A., & Hauser, J.R. (1996), 'Integrating R&D and Marketing: A Review and Analysis of the Literature',

Journal of Product Innovation Management, 13(3): 191-215
Hansen, M.T. (1999) "The Search-Transfer Problem" *Administrative Science Quarterly* 44(1): 82-111.
Hayek, F.A. (1945), 'The Use of Technology in Society', *American Economic Review*, 35(4), 519-530
Henkel, J. (2006) "Selective revealing in open innovation processes: The case of embedded Linux" *Research Policy* 33: 953-969.
Homans, G.C. (1950), *The Human Group*, New York: Harcourt, Brace
Jackman, R. W. & R. A. Miller (1998) 'Social Capital and Politics', *Annual Review of Political Science* 1: 47-73.
Kim, W.C., & Mauborgne, R. (1998) 'Procedural Justice, Strategic Decision Making, and the Knowledge
Economy' Strategic Management Journal 19(4): 323-338
Kogovsek, T., & Ferligoj, A., (2005), 'Effects of reliability and validity of ego-centered network measurements', Social Network, 27, 205-229
Kreiner, K., & Schultz, M. (1993) "Informal Collaboration in R&D." *Organization Studies* 14(2): 189-209
Leonard-Barton, D., & Deschamps, I. (1988), 'Managerial influence in the implementation of new technology', *Management Science*, 34(10), 1252-1265
Lesser, E.L. (ed) (2000), *Knowledge and Social Capital*. Butterworth Heinemann: Boston.
Macaulay, S. (1963), 'Non-contractual relations in business: A preliminary study', *American Sociological Review* [ASR], 28(1), 55 - 67.
Marin, A. (2004), 'Are respondents more likely to list alters with certain characteristics? Implications for name generator data', *Social Networks*, 26, 289-307
Marsden, P.V. (1990), 'Network data and measurement', *Annual Review of Sociology*, 16, 453-463
Mauss, M. (1954) [2000], *The Gift.* New York: Norton.
Merton, R.K., (1968) "The Matthew Effect in Science" Science 159: 56 - 63
Miles, R., & Snow, C. (1986), 'Organizations new concepts for new forms', *California Management Review*, 28, 62-73
Molm, L.D. (2003), 'Theoretical Comparisons of Forms of Exchange', *Sociological Theory*, 21(1), 1-17
Nahapiet, J., & Ghosal, S. (1998) 'Social capital, intellectual capital, and the organizational advantage', *Academy of* Management Review, 23(20), 242-266
Nonaka, I. (1994) 'A Dynamic Theory of Organizational Knowledge Creation' *Organization Science* 5(1): 14-37.
Obstfeld, D. (2005), ' Social Networks the Tertius Lungens Orientation, and Involvement in Innovation',
Administrative Science Quarterly, 50, 100-130.
Offer, A. (1997), 'Between the Gift and the Market: The Economy of Regard', *The Economic History Review,* 50(3), 450-476.
Ouchi, W.G. (1980) 'Markets, bureaucracies, and clans', *Administrative Science Quarterly* 25(1): 129-141
----, (1979) 'A Conceptual Framework for the Design of Organizational Control', *Management Science*
25(9): 833-848
Park, S.O. (2002) 'Regional innovation strategies in the knowledge-based economy' GeoJournal 53(1): 29-38
Portes, A. & Sensenbrenner, J. (1993), 'Embeddedness and immigration: notes on the social determinants of economic action', *American Journal of Sociology*, 98, 1320-1350.
Powell, W. (1990), 'Neither market nor hierarchy: Network forms of organization', *Research in Organization Behavior* 12: 295-336
Shapiro, S.P. (1987) 'The social control of impersonal trust', *American Journal of Sociology*, 93, 623-658
Sprecher, S. (1964), 'Investment model, equity, and social support determinants of relationship commitment', *Social Psychology Quarterly*, 51, 318-328
Sprengler, O. (1932), *Der Mensch und die Technik: Beitrag zu einer Philosophie des Lebens*, München: C.H. Beck'sche Verlagsbuchhandlung.
Szulanski, G. (1996) 'Exploring internal stickiness' *Strategic Management* 17: 27-43.
Thorelli, H.B. (1986), 'Networks: Between Markets and Hierarchies', *Strategic Management Journal*, 7(1), 37-51
Tsai, W. (2001), 'Knowledge transfer in intra-organizational networks' *Academy of Management Review* 44: 996-1004

Uehara, E. (1990) 'Dual Exchange Theory, Social Networks, and Informational Support', *The American Journal of Sociology* 96: 521-557.
Von Hippel, E. (1987) 'Cooperation between rivals: Informal know-how trading', *Research Policy,* 16: 291-302.
Wenger, E.C., & Snyder, W. (2000) 'Communities of Practice the Organizational Frontier' *Harvard Business Review*, 139-145.
Wenger, E.C. (1998) *Communities of Practice.* Cambridge: Cambridge UP.
Winter, S.G. & Szulanski, G (2001), 'Replication as Strategy, *Organization Science* 12(6): 730-743.
Woolcock, M. (1998) "Social Capital and Economic Development: towards a Theoretical synthesis and policy framework", *Theory and Society* 27(2): 151-208.
Zucker, L.G. (1986) 'Production of trust: Institutional sources of economic structure, 1840-1920.', *Research in Organizational Behavior* 8: 53-111

Summary

Firms' success in today's marketplace depends on their ability to innovate. Faced by this emerging reality, companies are spurred to manage, (re)combine and increase their knowledge stocks. This development has led to a recent and marked interest in the benefits of networks and technological aids for improving knowledge transfer. But the real question, as this book posits, is not so much what processes aid knowledge flows but how knowledge comes to be transferred to begin with. Companies' interests are obvious but not necessarily in line with those of its employees. Why would knowledge workers want to share knowledge in light of the potential costs?

The answer, as this book argues, lies (partly) in the observation that knowledge transfers continue to take place (efficiently) outside of the market (or hierarchy for that matter), by means of interpersonal gift exchange cycles. Thus while knowledge exchange is undoubtedly facilitated via market and hierarchy, an important part of the knowledge flows within and between companies is underpinned by gift exchange' principles. This study has empirically focused on intra-organizational knowledge transfers between R&D scientists, believed to be at the core of an organization's knowledge creation capability. At the same time, this book seeks to highlight gift exchange as an analytical framework for knowledge sharing, explaining both its value and its incidence.

The notion that economic value creation in general and knowledge creation in particular requires cooperation and coordination is investigated in chapter two. Indeed, coordination of human activity can take several forms. In addition to an all pervasive market mechanism, where prices coordinate, or a hierarchy epitomized by corporations, where authority coordinates, other forms have been suggested. Some have called these networks, others clans. This book suggests that the notion of gift exchange allows for the middle ground between market and hierarchy to be explored more fruitfully. The three coordination mechanisms are assessed in the context of knowledge creation and diffusion. Each has particular advantages, but those offered by gift exchange make it an effective and sometimes preferred alternative. Gift exchange's ability to coordinate, more so than any other mechanism, relies on the relationships between individuals in a community.

Chapter 3, introduces the notion of social capital capturing the idea that relationships and social networks are a valuable asset, in that they can facilitate action. As such, social capital resides in members of a group, **and** in their relations. Social capital allows actors to achieve ends which would be impossible to achieve without social capital, or only by means of (significant) additional costs. Social capital as a concept is relevant for understanding what is going on within and between companies in that it offers a conceptual mechanism for the intuitively compelling notion that the relationships individuals cultivate matter. Social capital represents especially within knowledge intensive environments, a potentially powerful tool for understanding why actors, in knowledge communities, continue to interact and cooperate. The creation, use, maintenance and depletion of social capital is, as is argued,

to be understood as a corollary of gift exchange.

Chapter 4 explores, in some detail, new knowledge creation within the context of the firm. As development of new knowledge is impossible without previously developed knowledge, actors are dependent on one another. The need for cooperation, specifically exchange of knowledge and information, stems from human (limited) knowledge and the distribution, dispersed in both time and space, of knowledge among various actors. Hence, firm innovativeness is largely dependent on the cooperation between people and the relationships they entertain within (and beyond) the firm. However, the extraordinary characteristics of knowledge (e.g. uncertainty, asymmetry and social dimensions related to knowledge) make the exchange of knowledge between people by no means an easy or self-evident process. Whenever achieving some goal involves the assistance of others, actors will still need to enlist the cooperation of other parties. In the context of innovations, for instance, relational ties and networks do play a crucial part in locating and accessing relevant knowledge. As such informal (and formal) cooperation between corporate scientists within and between firms is not an unknown observation, but tends not to be conceptualized in terms of gift exchange. This chapter argues that the notion of gift exchange allows one to explain why persons exchange knowledge with each other even if they are not obliged to by contract or instruction. Gifts can be non-material to include knowledge and are exchanged for multiple reasons. Gift exchange creates mutual trust as well as informal obligations between persons, and offers a perspective for understanding the way in which informal, but also formal relations take shape and how they may or may not contribute to knowledge transfer.

Bridging theory and empirics, chapter 5 elaborates on the particular research design adopted by this study and provides a description of the research setting. As such the companies and R&D organizations investigated, as the context for this study, are introduced in more detail.

In chapter 6 the conceptual contribution of relational and structural attributes to the production of knowledge are investigated. Empirically, we generate a network perspective of knowledge exchange using Social Network Analysis. In particular, this chapter tests the supposition that creative and productive researchers are more likely to inhabit favorable network positions and actively engage in exchange. The study shows mixed results in regards to the effect of gift exchange on innovation success. Although gift exchange incidence is associated with subjective innovation performance (e.g. creativity), this effect is not demonstrated for objective innovation performance (e.g. patents output). At the same time, the results indicate that an actor's position within the network (centrality) has a positive and significant effect on both subjective and objective innovation performance. In the sense that centrality is related to actors having larger networks with more exchange partners, maintaining an extended network positively contributes to individual innovativeness. Indeed, this result is in line with previous studies which indicate that as an actor's centrality increases and an actor is connected to more alters their access to resources and new and novel ideas increases.

The most important contributions of this book are made in the field of innovation. Contributions which ultimately translate into a number of academic and theoretical implications. If cooperation and knowledge transfers are indeed essential for the development of new knowledge, then understanding its drivers should be a priority. Even more so, since knowledge transfers have been shown to be anything but automatic. This book makes a case for viewing knowledge exchange as a complex process of give and take. As such, it introduces the human factor in an otherwise almost mechanical view of knowledge exchange. Indeed, knowledge exchanges oftentimes are purely interpersonal, driven by personal micro objectives and take place 'without management support or urging'. Such a perspective on knowledge sharing has marked implications for our view on how, when and under what circumstances people exchange knowledge. Theoretically, it may be a first step in tackling the action problem Social Network Analysis (SNA) is professed to suffer from- it fails to explain how people in a network actually share knowledge, using the network structure that is there. Managerially, a gift exchange perspective on knowledge exchange also has implications for the creation and inter- and intra-organizational sharing of knowledge. Implications for spill-over effects, organizational structure and innovation strategies are identified and discussed. This thesis contributes by elucidating the process by which knowledge comes to be created and utilized. The implications of which affect organizational innovation strategies. Strategies to facilitate and speed up innovation are sought after as firms strive to remain competitive. A challenge not to be taken lightly, given that knowledge in today's economic landscape is believed to be key to the ability of organizations to compete in an increasingly global playing field.

Nederlandse samenvatting

Het succes van organisaties in het hedendaags economisch speelveld hangt in toenemende mate samen met het vermogen om te innoveren. Geconfronteerd met deze realiteit, worden organisaties in toenemende mate aangezet tot het effectief managen, (her)combineren and vergroten van de aanwezige kennis. Deze ontwikkeling heeft geleid tot een groeiende interesse in de mogelijkheden van (kennis)netwerken en een scala van (IT-gerelateerde) hulpmiddelen om kennisuitwisseling binnen (en tussen) organisaties te verbeteren. De vraag is echter niet zozeer welke processen kennisuitwisseling kunnen faciliteren, als wel waarom kennisuitwisseling - alles in aanmerking nemend - nog steeds plaatsvindt. Het belang van organisaties is niet altijd noodzakelijkerwijs in overeenstemming met die van haar werknemers. Waarom zouden kenniswerkers kennis willen delen de potentiële kosten hiervan in aanmerking nemende?

Het antwoord, zoals dit boek beargumenteert, ligt (gedeeltelijk) in de observatie dat kennisdeling (efficiënt) plaats blijft vinden buiten de markt (en hiërarchie), door middel van interpersoonlijke gift uitwisselingscycli. Dus terwijl kennisuitwisseling ontegenzeggelijk gefaciliteerd wordt door de markt en hiërarchie, is tegelijkertijd een belangrijk deel van de kennisstromen binnen en tussen ondernemingen gebaseerd op de principes van giftuitwisseling. Deze studie onderzoekt zowel theoretisch als empirisch de inter-organisationele kennisuitwisseling tussen R&D onderzoekers, welke verondersteld worden nauw verbonden te zijn met het vermogen van organisaties om nieuwe kennis te creëren. Tegelijkertijd beoogt dit boek giftuitwisseling theoretisch nader in te bedden door zowel haar waarde als frequentie te verklaren.

De gedachte dat economische waardecreatie in het algemeen en kenniscreatie in het bijzonder coöperatie en coördinatie vereist staat aan de basis van hoofdstuk 2. In feite kan de coördinatie van menselijke activiteiten op verschillende manieren plaatsvinden. Naast een alomtegenwoordig markmechanisme, waar prijzen coördineren, en de hiërarchie, die allereerst geassocieerd wordt met de onderneming en waar autoriteit coördineert, zijn andere vormen voorgesteld. Sommigen noemen het alternatief netwerken, anderen clans. Dit boek stelt dat het concept van giftuitwisseling ons in staat stelt om het speelveld tussen markt en hiërarchie effectiever te onderzoeken. De drie genoemde coördinatiemechanismen worden beoordeeld in de context van kenniscreatie en diffusie. Elk van hen vertegenwoordigt specifieke voordelen, maar die van de gift maken het tot een effectief and soms geprefereerd alternatief. Het vermogen van giftuitwisseling om te coördineren, meer dan enig ander mechanisme, berust op de relaties tussen individuen in een gemeenschap.

Hoofdstuk 3 introduceert het begrip sociaal kapitaal, oftewel de gedachte dat relaties en sociale netwerken een concrete waarde vertegenwoordigen doordat zij actie in de brede zin van het woord kunnen faciliteren. Als zodanig, bevindt zich sociaal kapitaal in de leden van een groep, en hun onderlinge relaties. Sociaal kapitaal stelt individuen in staat doeleinden te bereiken die niet zonder sociaal kapitaal, of alleen tegen (significante)

additionele kosten, zouden kunnen worden bereikt. Sociaal kapitaal is relevant om te begrijpen wat er gebeurt in en tussen ondernemingen doordat het een conceptueel mechanisme aanreikt voor de intuïtief aansprekende gedachte dat de relaties waarover individuen beschikken van belang zijn. Sociaal kapitaal presenteert, in het bijzonder in kennisintensieve omgevingen, een potentieel krachtig instrument om te begrijpen waarom individuen, in kennisgemeenschappen, bestendige relaties en samenwerkingsverbanden onderhouden. Creatie, gebruik, onderhoud en verbruik van sociaal kapitaal moet, zoals wordt betoogd, worden gezien als een neveneffect van giftuitwisselingscycli.

Hoofdstuk 4 gaat nader in op het kenniscreatieproces binnen de context van de onderneming. Doordat de ontwikkeling van nieuwe kennis niet kan plaatsvinden zonder kennis van en toegang tot bestaande kennis, zijn actoren in zekere mate afhankelijk van elkaar. De noodzaak tot samenwerking, specifiek de uitwisseling van kennis en informatie, komt voort uit de gelimiteerde cognitieve capaciteiten van de mens alsmede de distributie, in zowel tijd als ruimte, van kennis tussen verschillende actoren. Om die reden is het innovatievermogen van ondernemingen in hoge mate afhankelijk van de samenwerking tussen mensen en relaties die zij onderhouden binnen (en buiten) de organisatie. Nochthans is de uitwisseling van kennis, ten gevolge van de buitengewone kenmerken van kennis (onder andere; onzekerheid, asymmetrie, en de sociale dimensies van kennis) in geen geval een eenvoudig of vanzelfsprekend proces. Telkens wanneer het bereiken van een doel de assistentie van anderen behoeft, zijn individuen genoodzaakt tot samenwerking met andere partijen. Dit gegeven krijgt in een innovatiecontext een additionele dimensie doordat relaties en netwerken een cruciale rol spelen in het lokaliseren van en toegang krijgen tot relevante kennis . Om die reden is informele (en formele) samenwerking tussen R&D onderzoekers zowel binnen als buiten de organisatie geen onbekende observatie, maar dit wordt in het algemeen niet geconceptualiseerd als een giftuitwisselingsproces. Dit hoofdstuk beargumenteert dat het concept van giftuitwisseling ons in staat stelt te verklaren waarom individuen kennis uitwisselen zelfs wanneer ze daartoe niet verplicht zijn door contract of instructie. Giften kunnen niet-fysiek zijn en als zodanig kennis omvatten waarbij de motieven voor uitwisseling divers kunnen zijn. Giftuitwisseling creëert wederzijds vertrouwen evenals informele verplichtingen tussen personen en biedt een perspectief om de wijze waarop informele maar ook formele relaties vorm krijgen, alsook hoe deze wel of niet kunnen bijdragen aan kennisuitwisseling.

Hoofdstuk 5 slaat de brug tussen theorie en empirie en biedt een beschrijving met betrekking tot de gekozen onderzoeksopzet evenals de specifieke onderzoeksomgeving. In het bijzonder worden de onderzochte bedrijven en de R&D organisaties, welke de context vormen voor deze studie, nader toegelicht.

In hoofdstuk 6 wordt de conceptuele bijdrage van relationele en structurele attributen op de productie van kennis onderzocht. Voor ons empirisch onderzoek generen we een netwerkperspectief op kennisuitwisseling gebruikmakend van Sociale Netwerk Analyse (SNA). Specifiek test dit hoofdstuk de propositie dat creatieve en productieve onderzoekers vaker gunstige netwerkposities innemen en vaker actief kennis via giftuitwisseling delen. De studie bood gemengde resultaten met betrekking tot het effect van giftuitwisseling op het

innovatiesucces. Alhoewel de frequentie waarmee individuen (kennis) giften uitwisselden gerelateerd was met subjectieve innovatieprestaties (oftewel de mate van creativiteit), kon dit effect niet aangetoond worden voor objectieve innovatieprestaties (oftewel toegekende patentaanvragen). Tegelijkertijd, tonen de resultaten aan dat de positie van een individu in een netwerk (oftewel de mate van centraliteit) een positief en significant effect heeft op zowel de subjectieve als objectieve prestatie-indicatoren voor innovatie. Voor zover centraliteit is gerelateerd aan de netwerkgrootte van individuen (dat wil zeggen, een netwerk met meer contacten), levert een omvangrijk netwerk een positieve contributie aan de innovativiteit van individuen. Een uitkomst die in lijn is met vorige studies, welke aantonen dat naarmate de centraliteit van een individu toeneemt en deze is verbonden met meer netwerkpartners zijn toegang tot nieuwe ideeën en kennis toeneemt.

De belangrijkste bijdrage van dit boek worden gemaakt aan het innovatie onderzoeksveld. Contributies die zich uiteindelijk vertalen in een aantal academische en theoretisch implicaties. Indien samenwerking and kennisuitwisseling essentieel zijn voor de ontwikkeling van nieuwe kennis, dan is een begrip van de onderliggende factoren 'drivers' een prioriteit. Temeer om dat kennisuitwisseling blijkens onderzoek alles behalve vanzelfsprekend is. Dit boek breekt een lans voor de conceptualisatie waarin kennisuitwisseling wordt geïnterpreteerd als een complex interpersoonlijk proces van geven en nemen. Als zodanig, introduceert het de menselijke factor in een onderzoeksveld waarin een voornamelijk mechanische en gedepersonaliseerd begrip van kennisuitwisseling wordt gehanteerd. In werkelijkheid, zijn kennisuitwisselingen vaak een puur interpersoonlijke aangelegenheid gedreven door persoonlijke microdoeleinden en vinden plaats 'zonder management, ondersteuning of aansporing'. Zulk een perspectief op kennisuitwisseling heeft aanzienlijke implicaties voor onze kijk op de vraag, hoe, wanneer en onder welke omstandigheden mensen kennis uitwisselen. Theoretisch, kan het een eerste stap zijn in het definiëren van een aanpak van het collectieve actie probleem waar Sociale Netwerk Analyse (SNA), zoals benoemd door sommigen, mee worstelt. Waarbij het actie probleem slaat op het achterwege blijven van een verklaring hoe mensen in een netwerk daadwerkelijk kennis delen op basis van de bestaande netwerkstructuur. Vanuit management oogpunt, heeft een giftuitwisselingsperspectief op kennisuitwisseling eveneens implicaties voor de creatie van inter- en intraorganisationele kennisdeling. Implicaties voor spill-over effecten, organisatiestructuur en innovatiestrategieën worden geïdentificeerd en besproken. Dit proefschrift draagt bij aan een verder begrip van het proces op basis waarvan kennis wordt gecreëerd en toegepast. De implicaties hiervan hebben ondermeer gevolgen voor de innovatiestrategie van organisaties. Strategieën om innovatie te faciliteren en te versnellen zijn veelal een organisatieprioriteit. Meer dan ooit speelt kennisproductie en innovatie een sleutelrol in het behoud **en** verstrekking van de concurrentiepositie van de organisatie.

About the author

Rene van der Eijk, studied in the Netherlands, United States and Germany graduating Cum Laude as an economist at the Erasmus University Rotterdam in 2003. He received a master's degree in Business Economics exploring the role of person-organization fit in organizational entry, recruitment, selection and newcomer socialization in his MA thesis. Beginning 2003 he worked as a researcher (A.i.O) at the Department of Management of Technology and Innovation at the Rotterdam School of Management, Erasmus University. Key research interests include person-organization fit, entrepreneurship, knowledge sharing, social networks, performance and innovation. In 2009, Rene van der Eijk obtained his doctorate in business administration in the area of innovation. He has been working on the subject at several multinational companies and has spoken on the topic at various international conferences. Rene van der Eijk has written and published articles on innovation, knowledge sharing and social networks.

ERASMUS RESEARCH INSTITUTE OF MANAGEMENT (ERIM)

ERIM PH.D. SERIES
RESEARCH IN MANAGEMENT

ERIM Electronic Series Portal: http://hdl.handle.net/1765/1

Althuizen, N.A.P., *Analogical Reasoning as a Decision Support Principle for Weakly Structured Marketing Problems*, Promotor: Prof.dr.ir. B. Wierenga, EPS-2006-095-MKT, ISBN: 90-5892-129-8, http://hdl.handle.net/1765/8190

Alvarez, H.L., *Distributed Collaborative Learning Communities Enabled by Information Communication Technology*, Promotor: Prof.dr. K. Kumar, EPS-2006-080-LIS, ISBN: 90-5892-112-3, http://hdl.handle.net/1765/7830

Appelman, J.H., *Governance of Global Interorganizational Tourism Networks: Changing Forms of Co-ordination between the Travel Agency and Aviation Sector*, Promotors: Prof.dr. F.M. Go & Prof.dr. B. Nooteboom, EPS-2004-036-MKT, ISBN: 90-5892-060-7, http://hdl.handle.net/1765/1199

Assem, M.J. van den, *Deal or No Deal? Decision Making under Risk in a Large-Stake TV Game Show and Related Experiments*, Promotor: Prof.dr. J. Spronk, EPS-2008-138-F&A, ISBN: 978-90-5892-173-4, http://hdl.handle.net/1765/1

Baquero, *G, On Hedge Fund Performance, Capital Flows and Investor Psychology*, Promotor: Prof.dr. M.J.C.M. Verbeek, EPS-2006-094-F&A, ISBN: 90-5892-131-X, http://hdl.handle.net/1765/8192

Berens, G., *Corporate Branding: The Development of Corporate Associations and their Influence on Stakeholder Reactions*, Promotor: Prof.dr. C.B.M. van Riel, EPS-2004-039-ORG, ISBN: 90-5892-065-8, http://hdl.handle.net/1765/1273

Berghe, D.A.F. van den, *Working Across Borders: Multinational Enterprises and the Internationalization of Employment*, Promotors: Prof.dr. R.J.M. van Tulder & Prof. dr. E.J.J. Schenk, EPS-2003-029-ORG, ISBN: 90-5892-05-34, http://hdl.handle.net/1765/1041

Berghman, L.A., *Strategic Innovation Capacity: A Mixed Method Study on Deliberate Strategic Learning Mechanisms*, Promotor: Prof.dr. P. Mattyssens, EPS-2006-087-MKT, ISBN: 90-5892-120-4, http://hdl.handle.net/1765/7991

Bijman, W.J.J., *Essays on Agricultural Co-operatives: Governance Structure in Fruit and Vegetable Chains*, Promotor: Prof.dr. G.W.J. Hendrikse, EPS-2002-015-ORG, ISBN: 90-5892-024-0, http://hdl.handle.net/1765/867

Bispo, A., *Labour Market Segmentation: An investigation into the Dutch hospitality industry*, Promotors: Prof.dr. G.H.M. Evers & Prof.dr. A.R. Thurik, EPS-2007-108-ORG, ISBN: 90-5892-136-9, http://hdl.handle.net/1765/10283

Blindenbach-Driessen, F., *Innovation Management in Project-Based Firms*, Promotor: Prof.dr. S.L. van de Velde, EPS-2006-082-LIS, ISBN: 90-5892-110-7, http://hdl.handle.net/1765/7828

Boer, C.A., *Distributed Simulation in Industry*, Promotors: Prof.dr. A. de Bruin & Prof.dr.ir. A. Verbraeck, EPS-2005-065-LIS, ISBN: 90-5892-093-3, http://hdl.handle.net/1765/6925

Boer, N.I., *Knowledge Sharing within Organizations: A situated and Relational Perspective*, Promotor: Prof.dr. K. Kumar, EPS-2005-060-LIS, ISBN: 90-5892-086-0, http://hdl.handle.net/1765/6770

Boer-Sorbán, K., *Agent-Based Simulation of Financial Markets: A modular, Continuous-Time Approach*, Promotor: Prof.dr. A. de Bruin, EPS-2008-119-LIS, ISBN: 90-5892-155-0, http://hdl.handle.net/1765/10870

Boon, C.T., *HRM and Fit: Survival of the Fittest!?*, Promotors: Prof.dr. J. Paauwe & Prof.dr. D.N. den Hartog, EPS-2008-129-ORG, ISBN: 978-90-5892-162-8, http://hdl.handle.net/1765/1

Braun, E., *City Marketing: Towards an Integrated Approach*, Promotor: Prof.dr. L. van den Berg, EPS-2008-142-MKT, ISBN: 978-90-5892-180-2, http://hdl.handle.net/1765/1

Brito, M.P. de, *Managing Reverse Logistics or Reversing Logistics Management?* Promotors: Prof.dr.ir. R. Dekker & Prof.dr. M. B. M. de Koster, EPS-2004-035-LIS, ISBN: 90-5892-058-5, http://hdl.handle.net/1765/1132

Brohm, R., *Polycentric Order in Organizations: A Dialogue between Michael Polanyi and IT-Consultants on Knowledge, Morality, and Organization*, Promotors: Prof.dr. G. W. J. Hendrikse & Prof.dr. H. K. Letiche, EPS-2005-063-ORG, ISBN: 90-5892-095-X, http://hdl.handle.net/1765/6911

Brumme, W.-H., *Manufacturing Capability Switching in the High-Tech Electronics Technology Life Cycle*, Promotors: Prof.dr.ir. J.A.E.E. van Nunen & Prof.dr.ir. L.N. Van Wassenhove, EPS-2008-126-LIS, ISBN: 978-90-5892-150-5, http://hdl.handle.net/1765/1

Burgers, J.H., *Managing Corporate Venturing: Multilevel Studies on Project Autonomy, Integration*, Knowledge Relatedness, and Phases in the New Business Development Process, Promotors: Prof.dr.ir. F.A.J. Van den Bosch & Prof.dr. H.W. Volberda, EPS-2008-136-STR, ISBN: 978-90-5892-174-1, http://hdl.handle.net/1765/1

Campbell, R.A.J., *Rethinking Risk in International Financial Markets,* Promotor: Prof.dr. C.G. Koedijk, EPS-2001-005-F&A, ISBN: 90-5892-008-9, http://hdl.handle.net/1765/306

Chen, H., *Individual Mobile Communication Services and Tariffs*, Promotor: Prof. dr. L.F.J.M. Pau, EPS-2008-123-LIS, ISBN: 90-5892-158-1, http://hdl.handle.net/1765/11141

Chen, Y., *Labour Flexibility in China's Companies: An Empirical Study*, Promotors: Prof. dr. A. Buitendam & Prof.dr. B. Krug, EPS-2001-006-ORG, ISBN: 90-5892-012-7, http://hdl.handle.net/1765/307

Damen, F.J.A., *Taking the Lead: The Role of Affect in Leadership Effectiveness*, Promotor: Prof.dr. D.L. van Knippenberg, EPS-2007-107-ORG, http://hdl.handle.net/1765/10282

Daniševská, P., *Empirical Studies on Financial Intermediation and Corporate Policies*, Promotor: Prof.dr. C.G. Koedijk, EPS-2004-044-F&A, ISBN: 90-5892-070-4, http://hdl.handle.net/1765/1518

Delporte-Vermeiren, D.J.E., *Improving the Flexibility and Profitability of ICT-enabled Business Networks: An Assessment Method and Tool*, Promotors: Prof. mr. dr. P.H.M. Vervest & Prof.dr.ir. H.W.G.M. van Heck, EPS-2003-020-LIS, ISBN: 90-5892-040-2, http://hdl.handle.net/1765/359

Derwall, J.M.M., *The Economic Virtues of SRI and CSR*, Promotor: Prof.dr. C.G. Koedijk, EPS-2007-101-F&A, ISBN: 90-5892-132-8, http://hdl.handle.net/1765/8986

Diepen, M. van, *Dynamics and Competition in Charitable Giving*, Promotor: Prof.dr. Ph.H.B.F. Franses, EPS-2009-159-MKT, ISBN: 978-90-5892-188-8, http://hdl.handle.net/1765/1

Dijksterhuis, M., *Organizational Dynamics of Cognition and Action in the Changing Dutch and US Banking Industries*, Promotors: Prof.dr.ir. F.A.J. van den Bosch & Prof. dr. H.W. Volberda, EPS-2003-026-STR, ISBN: 90-5892-048-8, http://hdl.handle.net/1765/1037

Elstak, M.N., *Flipping the Identity Coin: The Comparative Effect of Perceived, Projected and Desired Organizational Identity on Organizational Identification and Desired Behavior*, Promotor: Prof.dr. C.B.M. van Riel, EPS-2008-117-ORG, ISBN: 90-5892-148-2, http://hdl.handle.net/1765/10723

Erken, H.P.G., *Productivity, R&D and Entrepreneurship*, Promotor: Prof.dr. A.R. Thurik, EPS-2008-147-ORG, ISBN: 978-90-5892-179-6, http://hdl.handle.net/1765/1

Fenema, P.C. van, *Coordination and Control of Globally Distributed Software Projects*, Promotor: Prof.dr. K. Kumar, EPS-2002-019-LIS, ISBN: 90-5892-030-5, http://hdl.handle.net/1765/360

Fleischmann, M., *Quantitative Models for Reverse Logistics*, Promotors: Prof.dr.ir. J.A.E.E. van Nunen & Prof.dr.ir. R. Dekker, EPS-2000-002-LIS, ISBN: 35-4041-711-7, http://hdl.handle.net/1765/1044

Flier, B., *Strategic Renewal of European Financial Incumbents: Coevolution of Environmental Selection*, Institutional Effects, and Managerial Intentionality, Promotors: Prof.dr.ir. F.A.J. van den Bosch & Prof.dr. H.W. Volberda, EPS-2003-033-STR, ISBN: 90-5892-055-0, http://hdl.handle.net/1765/1071

Fok, D., *Advanced Econometric Marketing Models*, Promotor: Prof.dr. Ph.H.B.F. Franses, EPS-2003-027-MKT, ISBN: 90-5892-049-6, http://hdl.handle.net/1765/1035

Ganzaroli, A., *Creating Trust between Local and Global Systems*, Promotors: Prof.dr. K. Kumar & Prof.dr. R.M. Lee, EPS-2002-018-LIS, ISBN: 90-5892-031-3, http://hdl.handle.net/1765/361

Gilsing, V.A., *Exploration, Exploitation and Co-evolution in Innovation Networks*, Promotors: Prof.dr. B. Nooteboom & Prof.dr. J.P.M. Groenewegen, EPS-2003-032-ORG, ISBN: 90-5892-054-2, http://hdl.handle.net/1765/1040

Ginkel, W.P. van, *The Use of Distributed Information in Decision Making Groups: The Role of Shared Task Representations*, Promotor: Prof.dr. D. van Knippenberg, EPS-2007-097-ORG, http://hdl.handle.net/1765/8424

Govers, R., *Virtual Tourism Destination Image: Glocal Identities Constructed, Perceived and Experienced*, Promotors: Prof.dr. F.M. Go & Prof.dr. K. Kumar, EPS-2005-069-MKT, ISBN: 90-5892-107-7, http://hdl.handle.net/1765/6981

Graaf, G. de, *Tractable Morality: Customer Discourses of Bankers, Veterinarians and Charity Workers*, Promotors: Prof.dr. F. Leijnse & Prof.dr. T. van Willigenburg, EPS-2003-031-ORG, ISBN: 90-5892-051-8, http://hdl.handle.net/1765/1038

Groot, E.A. de, *Essays on Economic Cycles*, Promotors: Prof.dr. Ph.H.B.F. Franses & Prof.dr. H.R. Commandeur, EPS-2006-091-MKT, ISBN: 90-5892-123-9, http://hdl.handle.net/1765/8216

Gutkowska, A.B., *Essays on the Dynamic Portfolio Choice*, Promotor: Prof.dr. A.C.F. Vorst, EPS-2006-085-F&A, ISBN: 90-5892-118-2, http://hdl.handle.net/1765/7994

Hagemeijer, R.E., *The Unmasking of the Other*, Promotors: Prof.dr. S.J. Magala & Prof.dr. H.K. Letiche, EPS-2005-068-ORG, ISBN: 90-5892-097-6, http://hdl.handle.net/1765/6963

Halderen, M.D. van, *Organizational Identity Expressiveness and Perception Management: Principles for Expressing the Organizational Identity in Order to Manage the Perceptions and Behavioral Reactions of External Stakeholders*, Promotor: Prof.dr. S.B.M. van Riel, EPS-2008-122-ORG, ISBN: 90-5892-153-6, http://hdl.handle.net/1765/10872

Hartigh, E. den, *Increasing Returns and Firm Performance: An Empirical Study*, Promotor: Prof.dr. H.R. Commandeur, EPS-2005-067-STR, ISBN: 90-5892-098-4, http://hdl.handle.net/1765/6939

Hermans. J.M., *ICT in Information Services; Use and Deployment of the Dutch Securities Trade*, 1860-1970, Promotor: Prof.dr. drs. F.H.A. Janszen, EPS-2004-046-ORG, ISBN 90-5892-072-0, http://hdl.handle.net/1765/1793

Hessels, S.J.A., *International Entrepreneurship: Value Creation Across National Borders*, Promotor: Prof.dr. A.R. Thurik, EPS-2008-144-ORG, ISBN: 978-90-5892-181-9, http://hdl.handle.net/1765/1

Heugens, P.P.M.A.R., *Strategic Issues Management: Implications for Corporate Performance*, Promotors: Prof.dr.ir. F.A.J. van den Bosch & Prof.dr. C.B.M. van Riel, EPS-2001-007-STR, ISBN: 90-5892-009-9, http://hdl.handle.net/1765/358

Heuvel, W. van den, *The Economic Lot-Sizing Problem: New Results and Extensions*, Promotor: Prof.dr. A.P.L. Wagelmans, EPS-2006-093-LIS, ISBN: 90-5892-124-7, http://hdl.handle.net/1765/1805

Hoedemaekers, C.M.W., *Performance, Pinned down: A Lacanian Analysis of Subjectivity at Work*, Promotors: Prof.dr. S. Magala & Prof.dr. D.H. den Hartog, EPS-2008-121-ORG, ISBN: 90-5892-156-7, http://hdl.handle.net/1765/10871

Hooghiemstra, R., *The Construction of Reality: Cultural Differences in Self-serving Behaviour in Accounting Narratives*, Promotors: Prof.dr. L.G. van der Tas RA & Prof.dr. A.Th.H. Pruyn, EPS-2003-025-F&A, ISBN: 90-5892-047-X, http://hdl.handle.net/1765/871

Hu, Y., *Essays on the Governance of Agricultural Products: Cooperatives and Contract Farming*, Promotors: Prof.dr. G.W.J. Hendrkse & Prof.dr. B. Krug, EPS-2007-113-ORG, ISBN: 90-5892-145-1, http://hdl.handle.net/1765/10535

Huij, J.J., *New Insights into Mutual Funds: Performance and Family Strategies*, Promotor: Prof.dr. M.C.J.M. Verbeek, EPS-2007-099-F&A, ISBN: 90-5892-134-4, http://hdl.handle.net/1765/9398

Huurman, C.I., *Dealing with Electricity Prices*, Promotor: Prof.dr. C.D. Koedijk, EPS-2007-098-F&A, ISBN: 90-5892-130-1, http://hdl.handle.net/1765/9399

Iastrebova, K, *Manager's Information Overload: The Impact of Coping Strategies on Decision-Making Performance*, Promotor: Prof.dr. H.G. van Dissel, EPS-2006-077-LIS, ISBN: 90-5892-111-5, http://hdl.handle.net/1765/7329

Iwaarden, J.D. van, *Changing Quality Controls: The Effects of Increasing Product Variety and Shortening Product Life Cycles*, Promotors: Prof.dr. B.G. Dale & Prof.dr. A.R.T. Williams, EPS-2006-084-ORG, ISBN: 90-5892-117-4, http://hdl.handle.net/1765/7992

Jansen, J.J.P., *Ambidextrous Organizations*, Promotors: Prof.dr.ir. F.A.J. Van den Bosch & Prof.dr. H.W. Volberda, EPS-2005-055-STR, ISBN: 90-5892-081-X, http://hdl.handle.net/1765/6774

Jennen, M.G.J., *Empirical Essays on Office Market Dynamics*, Promotors: Prof.dr. C.G. Koedijk & Prof.dr. D. Brounen, EPS-2008-140-F&A, ISBN: 978-90-5892-176-5, http://hdl.handle.net/1765/1

Jong, C. de, *Dealing with Derivatives: Studies on the Role, Informational Content and Pricing of Financial Derivatives*, Promotor: Prof.dr. C.G. Koedijk, EPS-2003-023-F&A, ISBN: 90-5892-043-7, http://hdl.handle.net/1765/1043

Keizer, A.B., *The Changing Logic of Japanese Employment Practices: A Firm-Level Analysis of Four Industries*, Promotors: Prof.dr. J.A. Stam & Prof.dr. J.P.M. Groenewegen, EPS-2005-057-ORG, ISBN: 90-5892-087-9, http://hdl.handle.net/1765/6667

Kijkuit, R.C., *Social Networks in the Front End: The Organizational Life of an Idea*, Promotor: Prof.dr. B. Nooteboom, EPS-2007-104-ORG, ISBN: 90-5892-137-6, http://hdl.handle.net/1765/10074

Kippers, J., *Empirical Studies on Cash Payments*, Promotor: Prof.dr. Ph.H.B.F. Franses, EPS-2004-043-F&A, ISBN: 90-5892-069-0, http://hdl.handle.net/1765/1520

Klein, M.H., *Poverty Alleviation through Sustainable Strategic Business Models: Essays on Poverty Alleviation as a Business Strategy*, Promotor: Prof.dr. H.R. Commandeur, EPS-2008-135-STR, ISBN: 978-90-5892-168-0, http://hdl.handle.net/1765/1

Knapp, S., *The Econometrics of Maritime Safety: Recommendations to Enhance Safety at Sea*, Promotor: Prof.dr. Ph.H.B.F. Franses, EPS-2007-096-ORG, ISBN: 90-5892-127-1, http://hdl.handle.net/1765/7913

Kole, E., *On Crises, Crashes and Comovements*, Promotors: Prof.dr. C.G. Koedijk & Prof.dr. M.J.C.M. Verbeek, EPS-2006-083-F&A, ISBN: 90-5892-114-X, http://hdl.handle.net/1765/7829

Kooij-de Bode, J.M., *Distributed Information and Group Decision-Making: Effects of Diversity and Affect*, Promotor: Prof.dr. D.L. van Knippenberg, EPS-2007-115-ORG, http://hdl.handle.net/1765/10722

Koppius, O.R., *Information Architecture and Electronic Market Performance*, Promotors: Prof.dr. P.H.M. Vervest & Prof.dr.ir. H.W.G.M. van Heck, EPS-2002-013-LIS, ISBN: 90-5892-023-2, http://hdl.handle.net/1765/921

Kotlarsky, J., *Management of Globally Distributed Component-Based Software Development Projects*, Promotor: Prof.dr. K. Kumar, EPS-2005-059-LIS, ISBN: 90-5892-088-7, http://hdl.handle.net/1765/6772

Krauth, E.I., *Real-Time Planning Support: A Task-Technology Fit Perspective*, Promotors: Prof.dr. S.L. van de Velde & Prof.dr. J. van Hillegersberg, EPS-2008-155-LIS, ISBN: 978-90-5892-193-2, http://hdl.handle.net/1765/1

Kuilman, J., *The Re-Emergence of Foreign Banks in Shanghai: An Ecological Analysis*, Promotor: Prof.dr. B. Krug, EPS-2005-066-ORG, ISBN: 90-5892-096-8, http://hdl.handle.net/1765/6926

Langen, P.W. de, *The Performance of Seaport Clusters: A Framework to Analyze Cluster Performance and an Application to the Seaport Clusters of Durban, Rotterdam and the Lower Mississippi*, Promotors: Prof.dr. B. Nooteboom & Prof. drs. H.W.H. Welters, EPS-2004-034-LIS, ISBN: 90-5892-056-9, http://hdl.handle.net/1765/1133

Le Anh, T., *Intelligent Control of Vehicle-Based Internal Transport Systems*, Promotors: Prof.dr. M.B.M. de Koster & Prof.dr.ir. R. Dekker, EPS-2005-051-LIS, ISBN: 90-5892-079-8, http://hdl.handle.net/1765/6554

Le-Duc, T., *Design and Control of Efficient Order Picking Processes*, Promotor: Prof. dr. M.B.M. de Koster, EPS-2005-064-LIS, ISBN: 90-5892-094-1, http://hdl.handle.net/1765/6910

Leeuwen, E.P. van, *Recovered-Resource Dependent Industries and the Strategic Renewal of Incumbent Firm: A Multi-Level Study of Recovered Resource Dependence Management and Strategic Renewal in the European Paper and Board Industry*, Promotors: Prof.dr.ir. F.A.J. Van den Bosch & Prof.dr. H.W. Volberda, EPS-2007-109-STR, ISBN: 90-5892-140-6, http://hdl.handle.net/1765/10183

Lentink, R.M., *Algorithmic Decision Support for Shunt Planning*, Promotors: Prof.dr. L.G. Kroon & Prof.dr.ir. J.A.E.E. van Nunen, EPS-2006-073-LIS, ISBN: 90-5892-104-2, http://hdl.handle.net/1765/7328

Liang, G., *New Competition: Foreign Direct Investment and Industrial Development in China*, Promotor: Prof.dr. R.J.M. van Tulder, EPS-2004-047-ORG, ISBN: 90-5892-073-9, http://hdl.handle.net/1765/1795

Liere, D.W. van, *Network Horizon and the Dynamics of Network Positions: A Multi-Method Multi-Level Longitudinal Study of Interfirm Networks*, Promotor: Prof.dr. P.H.M. Vervest, EPS-2007-105-LIS, ISBN: 90-5892-139-0, http://hdl.handle.net/1765/10181

Loef, J., *Incongruity between Ads and Consumer Expectations of Advertising*, Promotors: Prof.dr. W.F. van Raaij & Prof.dr. G. Antonides, EPS-2002-017-MKT, ISBN: 90-5892-028-3, http://hdl.handle.net/1765/869

Maeseneire, W., *de, Essays on Firm Valuation and Value Appropriation*, Promotor: Prof.dr. J.T.J. Smit, EPS-2005-053-F&A, ISBN: 90-5892-082-8, http://hdl.handle.net/1765/6768

Londoño, M. del Pilar, *Institutional Arrangements that Affect Free Trade Agreements: Economic Rationality Versus Interest Groups*, Promotors: Prof.dr. H.E. Haralambides & Prof.dr. J.F. Francois, EPS-2006-078-LIS, ISBN: 90-5892-108-5, http://hdl.handle.net/1765/7578

Maas, A.A., *van der, Strategy Implementation in a Small Island Context: An Integrative Framework*, Promotor: Prof.dr. H.G. van Dissel, EPS-2008-127-LIS, ISBN: 978-90-5892-160-4, http://hdl.handle.net/1765/1

Maeseneire, W., de, *Essays on Firm Valuation and Value Appropriation*, Promotor: Prof.dr. J.T.J. Smit, EPS-2005-053-F&A, ISBN: 90-5892-082-8, http://hdl.handle.net/1765/6768

Mandele, L.M., van der, *Leadership and the Inflection Point: A Longitudinal Perspective*, Promotors: Prof.dr. H.W. Volberda & Prof.dr. H.R. Commandeur, EPS-2004-042-STR, ISBN: 90-5892-067-4, http://hdl.handle.net/1765/1302

Meer, J.R. van der, *Operational Control of Internal Transport*, Promotors: Prof.dr. M.B.M. de Koster & Prof.dr.ir. R. Dekker, EPS-2000-001-LIS, ISBN: 90-5892-004-6, http://hdl.handle.net/1765/859

Mentink, A., *Essays on Corporate Bonds*, Promotor: Prof.dr. A.C.F. Vorst, EPS-2005-070-F&A, ISBN: 90-5892-100-X, http://hdl.handle.net/1765/7121

Meyer, R.J.H., *Mapping the Mind of the Strategist: A Quantitative Methodology for Measuring the Strategic Beliefs of Executives*, Promotor: Prof.dr. R.J.M. van Tulder, EPS-2007-106-ORG, ISBN: 978-90-5892-141-3, http://hdl.handle.net/1765/10182

Miltenburg, P.R., *Effects of Modular Sourcing on Manufacturing Flexibility in the Automotive Industry: A Study among German OEMs*, Promotors: Prof.dr. J. Paauwe & Prof.dr. H.R. Commandeur, EPS-2003-030-ORG, ISBN: 90-5892-052-6, http://hdl.handle.net/1765/1039

Moerman, G.A., *Empirical Studies on Asset Pricing and Banking in the Euro Area*, Promotor: Prof.dr. C.G. Koedijk, EPS-2005-058-F&A, ISBN: 90-5892-090-9, http://hdl.handle.net/1765/6666

Moitra, D., *Globalization of R&D: Leveraging Offshoring for Innovative Capability and Organizational Flexibility*, Promotor: Prof.dr. K. Kumar, EPS-2008-150-LIS, ISBN: 978-90-5892-184-0, http://hdl.handle.net/1765/1

Mol, M.M., *Outsourcing, Supplier-relations and Internationalisation: Global Source Strategy as a Chinese Puzzle*, Promotor: Prof.dr. R.J.M. van Tulder, EPS-2001-010-ORG, ISBN: 90-5892-014-3, http://hdl.handle.net/1765/355

Mom, T.J.M., *Managers' Exploration and Exploitation Activities: The Influence of Organizational Factors and Knowledge Inflows*, Promotors: Prof.dr.ir. F.A.J. Van den Bosch & Prof.dr. H.W. Volberda, EPS-2006-079-STR, ISBN: 90-5892-116-6, http://hdl.handle.net/1765

Mulder, A., *Government Dilemmas in the Private Provision of Public Goods*, Promotor: Prof.dr. R.J.M. van Tulder, EPS-2004-045-ORG, ISBN: 90-5892-071-2, http://hdl.handle.net/1765/1790

Muller, A.R., *The Rise of Regionalism: Core Company Strategies Under The Second Wave of Integration*, Promotor: Prof.dr. R.J.M. van Tulder, EPS-2004-038-ORG, ISBN: 90-5892-062-3, http://hdl.handle.net/1765/1272

Nalbantov G.I., *Essays on Some Recent Penalization Methods with Applications in Finance and Marketing*, Promotor: Prof. dr P.J.F. Groenen, EPS-2008-132-F&A, ISBN: 978-90-5892-166-6, http://hdl.handle.net/1765/1

Nguyen, T.T., *Capital Structure, Strategic Competition, and Governance*, Promotor: Prof. dr. A. de Jong, EPS-2008-148-F&A, ISBN: 90-5892-178-9, http://hdl.handle.net/1765/1

Nieuwenboer, N.A. den, *Seeing the Shadow of the Self*, Promotor: Prof.dr. S.P. Kaptein, EPS-2008-151-ORG, ISBN: 978-90-5892-182-6, http://hdl.handle.net/1765/1

Ning, H., *Hierarchical Portfolio Management: Theory and Applications*, Promotor: Prof.dr. J. Spronk, EPS-2007-118-F&A, ISBN: 90-5892-152-9, http://hdl.handle.net/1765/10868

Noeverman, J., *Management Control Systems, Evaluative Style, and Behaviour: Exploring the Concept and Behavioural Consequences of Evaluative Style*, Promotors: Prof.dr. E.G.J. Vosselman & Prof.dr. A.R.T. Williams, EPS-2007-120-F&A, ISBN: 90-5892-151-2, http://hdl.handle.net/1765/10869

Oosterhout, J., van, *The Quest for Legitimacy: On Authority and Responsibility in Governance*, Promotors: Prof.dr. T. van Willigenburg & Prof.mr. H.R. van Gunsteren, EPS-2002-012-ORG, ISBN: 90-5892-022-4, http://hdl.handle.net/1765/362

Paape, L., *Corporate Governance: The Impact on the Role, Position, and Scope of Services of the Internal Audit Function*, Promotors: Prof.dr. G.J. van der Pijl & Prof. dr. H. Commandeur, EPS-2007-111-MKT, ISBN: 90-5892-143-7, http://hdl.handle.net/1765/10417

Pak, K., *Revenue Management: New Features and Models*, Promotor: Prof.dr.ir. R. Dekker, EPS-2005-061-LIS, ISBN: 90-5892-092-5, http://hdl.handle.net/1765/362/6771

Pattikawa, L.H, *Innovation in the Pharmaceutical Industry: Evidence from Drug Introduction in the U.S.*, Promotors: Prof.dr. H.R.Commandeur, EPS-2007-102-MKT, ISBN: 90-5892-135-2, http://hdl.handle.net/1765/9626

Peeters, L.W.P., *Cyclic Railway Timetable Optimization*, Promotors: Prof.dr. L.G. Kroon & Prof.dr.ir. J.A.E.E. van Nunen, EPS-2003-022-LIS, ISBN: 90-5892-042-9, http://hdl.handle.net/1765/429

Pietersz, R., *Pricing Models for Bermudan-style Interest Rate Derivatives*, Promotors: Prof.dr. A.A.J. Pelsser & Prof.dr. A.C.F. Vorst, EPS-2005-071-F&A, ISBN: 90-5892-099-2, http://hdl.handle.net/1765/7122

Poel, A.M. van der, *Empirical Essays in Corporate Finance and Financial Reporting*, Promotors: Prof.dr. A. de Jong & Prof.dr. G.M.H. Mertens, EPS-2007-133-F&A, ISBN: 978-90-5892-165-9, http://hdl.handle.net/1765/1

Popova, V., *Knowledge Discovery and Monotonicity*, Promotor: Prof.dr. A. de Bruin, EPS-2004-037-LIS, ISBN: 90-5892-061-5, http://hdl.handle.net/1765/1201

Pouchkarev, I., *Performance Evaluation of Constrained Portfolios*, Promotors: Prof.dr. J. Spronk & Dr. W.G.P.M. Hallerbach, EPS-2005-052-F&A, ISBN: 90-5892-083-6, http://hdl.handle.net/1765/6731

Prins, R., *Modeling Consumer Adoption and Usage of Value-Added Mobile Services*, Promotors: Prof.dr. Ph.H.B.F. Franses & Prof.dr. P.C. Verhoef, EPS-2008-128-MKT, ISBN: 978/90-5892-161-1, http://hdl.handle.net/1765/1

Puvanasvari Ratnasingam, P., *Interorganizational Trust in Business to Business E-Commerce*, Promotors: Prof.dr. K. Kumar & Prof.dr. H.G. van Dissel, EPS-2001-009-LIS, ISBN: 90-5892-017-8, http://hdl.handle.net/1765/356

Quak, H.J., *Sustainability of Urban Freight Transport: Retail Distribution and Local Regulation in Cities*, Promotor: Prof.dr. M.B.M. de Koster, EPS-2008-124-LIS, ISBN: 978-90-5892-154-3, http://hdl.handle.net/1765/11990

Quariguasi Frota Nero, J., *Eco-efficient Supply Chains for Electrical and Electronic Products*, Promotors: Prof.dr.ir. J.A.E.E. van Nunen & Prof.dr.ir. H.W.G.M. van Heck, EPS-2008-152-LIS, ISBN: 978-90-5892-192-5, http://hdl.handle.net/1765/1

Radkevitch, U.L, *Online Reverse Auction for Procurement of Services*, Promotor: Prof.dr.ir. H.W.G.M. van Heck, EPS-2008-137-LIS, ISBN: 978-90-5892-171-0, http://hdl.handle.net/1765/1

Rinsum, M. van, *Performance Measurement and Managerial Time Orientation*, Promotor: Prof.dr. F.G.H. Hartmann, EPS-2006-088-F&A, ISBN: 90-5892-121-2, http://hdl.handle.net/1765/7993

Romero Morales, D., *Optimization Problems in Supply Chain Management*, Promotors: Prof.dr.ir. J.A.E.E. van Nunen & Dr. H.E. Romeijn, EPS-2000-003-LIS, ISBN: 90-9014078-6, http://hdl.handle.net/1765/865

Roodbergen, K.J., *Layout and Routing Methods for Warehouses,* Promotors: Prof.dr. M.B.M. de Koster & Prof.dr.ir. J.A.E.E. van Nunen, EPS-2001-004-LIS, ISBN: 90-5892-005-4, http://hdl.handle.net/1765/861

Rook, L., *Imitation in Creative Task Performance*, Promotor: Prof.dr. D.L. van Knippenberg, EPS-2008-125-ORG, http://hdl.handle.net/1765/11555

Samii, R., *Leveraging Logistics Partnerships: Lessons from Humanitarian Organizations*, Promotors: Prof.dr.ir. J.A.E.E. van Nunen & Prof.dr.ir. L.N. Van Wassenhove, EPS-2008-153-LIS, ISBN: 978-90-5892-186-4, http://hdl.handle.net/1765/1

Schaik, D. van, *M&A in Japan: An Analysis of Merger Waves and Hostile Takeovers*, Promotors: Prof.dr. J. Spronk & Prof.dr. J.P.M. Groenewegen, EPS-2008-141-F&A, ISBN: 978-90-5892-169-7, http://hdl.handle.net/1765/1

Schauten, M.B.J., *Valuation, Capital Structure Decisions and the Cost of Capital*, Promotors: Prof.dr. J. Spronk & Prof.dr. D. van Dijk, EPS-2008-134-F&A, ISBN: 978-90-5892-172-7, http://hdl.handle.net/1765/1

Schramade, W.L.J., *Corporate Bonds Issuers*, Promotor: Prof.dr. A. De Jong, EPS-2006-092-F&A, ISBN: 90-5892-125-5, http://hdl.handle.net/1765/8191

Schweizer, T.S., *An Individual Psychology of Novelty-Seeking, Creativity and Innovation*, Promotor: Prof.dr. R.J.M. van Tulder, EPS-2004-048-ORG, ISBN: 90-5892-077-1, http://hdl.handle.net/1765/1818

Six, F.E., *Trust and Trouble: Building Interpersonal Trust Within Organizations*, Promotors: Prof.dr. B. Nooteboom & Prof.dr. A.M. Sorge, EPS-2004-040-ORG, ISBN: 90-5892-064-X, http://hdl.handle.net/1765/1271

Slager, A.M.H., *Banking across Borders*, Promotors: Prof.dr. R.J.M. van Tulder & Prof.dr. D.M.N. van Wensveen, EPS-2004-041-ORG, ISBN: 90-5892-066–6, http://hdl.handle.net/1765/1301

Sloot, L., *Understanding Consumer Reactions to Assortment Unavailability*, Promotors: Prof.dr. H.R. Commandeur, Prof.dr. E. Peelen & Prof.dr. P.C. Verhoef, EPS-2006-074-MKT, ISBN: 90-5892-102-6, http://hdl.handle.net/1765/7438

Smit, W., *Market Information Sharing in Channel Relationships: Its Nature, Antecedents and Consequences*, Promotors: Prof.dr.ir. G.H. van Bruggen & Prof.dr.ir. B. Wierenga, EPS-2006-076-MKT, ISBN: 90-5892-106-9, http://hdl.handle.net/1765/7327

Sonnenberg, M., *The Signalling Effect of HRM on Psychological Contracts of Employees: A Multi-level Perspective*, Promotor: Prof.dr. J. Paauwe, EPS-2006-086-ORG, ISBN: 90-5892-119-0, http://hdl.handle.net/1765/7995

Speklé, R.F., *Beyond Generics: A closer Look at Hybrid and Hierarchical Governance*, Promotor: Prof.dr. M.A. van Hoepen RA, EPS-2001-008-F&A, ISBN: 90-5892-011-9, http://hdl.handle.net/1765/357

Stam, D.A., *Managing Dreams and Ambitions: A Psychological Analysis of Vision Communication*, Promotor: Prof.dr. D.L. van Knippenberg, EPS-2008-149-ORG, http://hdl.handle.net/1765/1

Stienstra, M., *Strategic Renewal in Regulatory Environments: How Inter- and Intra-organisational Institutional Forces Influence European Energy Incumbent Firms*, Promotors: Prof.dr.ir. F.A.J. Van den Bosch & Prof.dr. H.W. Volberda,, EPS-2008-145-STR, ISBN: 978-90-5892-184-0, http://hdl.handle.net/1765/1

Szkudlarek, B.A., *Spinning the Web of Reentry: [Re]connecting reentry training theory and practice*, Promotor: Prof.dr. S.J. Magala, EPS-2008-143-ORG, ISBN: 978-90-5892-177-2, http://hdl.handle.net/1765/1

Teunter, L.H., *Analysis of Sales Promotion Effects on Household Purchase Behavior*, Promotors: Prof.dr.ir. B. Wierenga & Prof.dr. T. Kloek, EPS-2002-016-MKT, ISBN: 90-5892-029-1, http://hdl.handle.net/1765/868

Tims, B., *Empirical Studies on Exchange Rate Puzzles and Volatility*, Promotor: Prof. dr. C.G. Koedijk, EPS-2006-089-F&A, ISBN: 90-5892-113-1, http://hdl.handle.net/1765/8066

Tuk, M.A., *Is Friendship Silent When Money Talks? How Consumers Respond to Word-of-Mouth Marketing*, Promotors: Prof.dr.ir. A. Smidts & Prof.dr. D.H.J. Wigboldus, EPS-2008-130-MKT, ISBN: 978-90-5892-164-2, http://hdl.handle.net/1765/1

Valck, K. de, *Virtual Communities of Consumption: Networks of Consumer Knowledge and Companionship*, Promotors: Prof.dr.ir. G.H. van Bruggen & Prof.dr.ir. B. Wierenga, EPS-2005-050-MKT, ISBN: 90-5892-078-X, http://hdl.handle.net/1765/6663

Valk, W. van der, *Buyer-Seller Interaction Patterns During Ongoing Service Exchange*, Promotors: Prof.dr. J.Y.F. Wynstra & Prof.dr.ir. B. Axelsson, EPS-2007-116-MKT, ISBN: 90-5892-146-8, http://hdl.handle.net/1765/10856

Verheul, I., *Is There a (Fe)male Approach? Understanding Gender Differences in Entrepreneurship*, Prof.dr. A.R. Thurik, EPS-2005-054-ORG, ISBN: 90-5892-080-1, http://hdl.handle.net/1765/2005

Verwijmeren, P., *Empirical Essays on Debt, Equity, and Convertible Securities*, Promotors: Prof.dr. A. de Jong & Prof.dr. M.J.C.M. Verbeek, EPS-2009-154-F&A, ISBN: 978-90-5892-187-1, http://hdl.handle.net/1765/1

Vis, I.F.A., *Planning and Control Concepts for Material Handling Systems*, Promotors: Prof.dr. M.B.M. de Koster & Prof.dr.ir. R. Dekker, EPS-2002-014-LIS, ISBN: 90-5892-021-6, http://hdl.handle.net/1765/866

Vlaar, P.W.L., *Making Sense of Formalization in Interorganizational Relationships: Beyond Coordination and Control*, Promotors: Prof.dr.ir. F.A.J. Van den Bosch & Prof.dr. H.W. Volberda, EPS-2006-075-STR, ISBN 90-5892-103-4, http://hdl.handle.net/1765/7326

Vliet, P. van, *Downside Risk and Empirical Asset Pricing*, Promotor: Prof.dr. G.T. Post, EPS-2004-049-F&A, ISBN: 90-5892-07-55, http://hdl.handle.net/1765/1819

Vlist, P. van der, *Synchronizing the Retail Supply Chain*, Promotors: Prof.dr.ir. J.A.E.E. van Nunen & Prof.dr. A.G. de Kok, EPS-2007-110-LIS, ISBN: 90-5892-142-0, http://hdl.handle.net/1765/10418

Vries-van Ketel E. de, *How Assortment Variety Affects Assortment Attractiveness: A Consumer Perspective*, Promotors: Prof.dr. G.H. van Bruggen & Prof.dr.ir. A. Smidts, EPS-2006-072-MKT, ISBN: 90-5892-101-8, http://hdl.handle.net/1765/7193

Vromans, M.J.C.M., *Reliability of Railway Systems*, Promotors: Prof.dr. L.G. Kroon, Prof.dr.ir. R. Dekker & Prof.dr.ir. J.A.E.E. van Nunen, EPS-2005-062-LIS, ISBN: 90-5892-089-5, http://hdl.handle.net/1765/6773

Vroomen, B.L.K., *The Effects of the Internet, Recommendation Quality and Decision Strategies on Consumer Choice*, Promotor: Prof.dr. Ph.H.B.F. Franses, EPS-2006-090-MKT, ISBN: 90-5892-122-0, http://hdl.handle.net/1765/8067

Waal, T. de, *Processing of Erroneous and Unsafe Data*, Promotor: Prof.dr.ir. R. Dekker, EPS-2003-024-LIS, ISBN: 90-5892-045-3, http://hdl.handle.net/1765/870

Watkins Fassler, K., *Macroeconomic Crisis and Firm Performance*, Promotors: Prof.dr. J. Spronk & Prof.dr. D.J. van Dijk, EPS-2007-103-F&A, ISBN: 90-5892-138-3, http://hdl.handle.net/1765/10065

Wennekers, A.R.M., *Entrepreneurship at Country Level: Economic and Non-Economic Determinants*, Promotor: Prof.dr. A.R. Thurik, EPS-2006-81-ORG, ISBN: 90-5892-115-8, http://hdl.handle.net/1765/7982

Wielemaker, M.W., *Managing Initiatives: A Synthesis of the Conditioning and Knowledge-Creating View*, Promotors: Prof.dr. H.W. Volberda & Prof.dr. C.W.F. Baden-Fuller, EPS-2003-28-STR, ISBN: 90-5892-050-X, http://hdl.handle.net/1765/1042

Wijk, R.A.J.L. van, *Organizing Knowledge in Internal Networks: A Multilevel Study*, Promotor: Prof.dr.ir. F.A.J. van den Bosch, EPS-2003-021-STR, ISBN: 90-5892-039-9, http://hdl.handle.net/1765/347

Wolters, M.J.J., *The Business of Modularity and the Modularity of Business*, Promotors: Prof. mr. dr. P.H.M. Vervest & Prof. dr. ir. H.W.G.M. van Heck, EPS-2002-011-LIS, ISBN: 90-5892-020-8, http://hdl.handle.net/1765/920

Zhang, X., *Strategizing of Foreign Firms in China: An Institution-based Perspective*, Promotor: Prof.dr. B. Krug, EPS-2007-114-ORG, ISBN: 90-5892-147-5, http://hdl.handle.net/1765/10721

Zhu, Z., *Essays on China's Tax System*, Promotors: Prof.dr. B. Krug & Prof.dr. G.W.J. Hendrikse, EPS-2007-112-ORG, ISBN: 90-5892-144-4, http://hdl.handle.net/1765/10502

Zwart, G.J. de, *Empirical Studies on Financial Markets: Private Equity, Corporate Bonds and Emerging Markets*, Promotors: Prof.dr. M.J.C.M. Verbeek & Prof.dr. D.J.C. van Dijk, EPS-2008-131-F&A, ISBN: 978-90-5892-163-5, http://hdl.handle.net/1765/1

BEHIND NETWORKS:
KNOWLEDGE TRANSFER, FAVOR EXCHANGE AND PERFORMANCE

The value of knowledge for economic development can hardly be overstated as it essentially determines *what* organizations do as well as *how* they do it. To ensure firm survival or meet fierce competition, organizations are required to continually improve their product and operations. That is, upgrade their knowledge base and develop new knowledge on how to do the right things more efficiently. Managing organizational knowledge and stimulating its development means that firms must carefully consider their knowledge development and diffusion strategies. Doing so, as this book argues, requires practitioners to realize that knowledge development and diffusion is a social cooperative process. At its most basic level new knowledge is created as a result of human interaction. Knowledge is shared between individuals and is fueled by micro-objectives and motivations. Applying a micro perspective, this book posits that knowledge exchange resembles the exchange of gifts. It follows that professional networks, as the conduits through which knowledge is exchanged, are an important determinant for scientists' performance. Utilizing the full potential of organizational scientific and human technical capital requires firms to map, shape and encourage individual network formation.

ERIM

The Erasmus Research Institute of Management (ERIM) is the Research School (Onderzoekschool) in the field of management of the Erasmus University Rotterdam. The founding participants of ERIM are Rotterdam School of Management (RSM), and the Erasmus School of Economics (ESE). ERIM was founded in 1999 and is officially accredited by the Royal Netherlands Academy of Arts and Sciences (KNAW). The research undertaken by ERIM is focussed on the management of the firm in its environment, its intra- and interfirm relations, and its business processes in their interdependent connections.

The objective of ERIM is to carry out first rate research in management, and to offer an advanced doctoral programme in Research in Management. Within ERIM, over three hundred senior researchers and PhD candidates are active in the different research programmes. From a variety of academic backgrounds and expertises, the ERIM community is united in striving for excellence and working at the forefront of creating new business knowledge.

Design & layout: B&T Ontwerp en advies (www.b-en-t.nl) Print: Haveka (www.haveka.nl)

Erasmus Research Institute of Management - ERIM

ERIM PhD Series
Research in Management

Erasmus Research Institute of Management - **ERIM**
Rotterdam School of Management (RSM)
Erasmus School of Economics (ESE)
P.O. Box 1738, 3000 DR Rotterdam
The Netherlands

Tel. +31 10 408 11 82
Fax +31 10 408 96 40
E-mail info@erim.eur.nl
Internet www.erim.eur.nl